JANUARY, 1957

Commercial Fertilizer

and PLANT FOOD INDUSTRY

MORE SELL FOR YOUR FERTILIZER

See page 21

Are you good at figures?
EXAMPLE 1
Valve Bags for Granular or Pulverized Materials
If you increased filling production from 12 per minute to 15 or more per minute—without paying a penny more for sleeve or special insert bags... what would be the percentage of increase—and dollar savings to you—per ton—per hour?
EXAMPLE 2
Open Mouth Bags for Free Flowing Materials
If you increased filling production from 15 per minute to 20 or more per minute—without paying a penny more for your open mouth multiwall bags... what would be the percentage of increase—and dollar savings to you—per ton—per hour?

KRAFT BAG CORPORATION

Gilman Paper Company Subsidiary

630 Fifth Avenue, New York 20, N. Y.
Daily News Bldg., Chicago 6, Ill.

check and mail today

- ☐ We are interested in Example 1.
- ☐ We are interested in Example 2.
- ☐ We are interested in both examples.

NAME OF COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____ PRINCIPAL_____

PRODUCT MFD._____

We have the bags and the packer to effect such savings—*or more!*

Give us the time to give you the facts!

Dependable as a service for 3 generations. Exclusive Sales Agents for the Kraft-packer Automatic Filling Machine and one of the largest integrated producers of multiwall bags with plants in St. Marys, Georgia and Gilman, Vermont, manufacturing every type of multiwall bag in use today!

..and quality you can *talk* about!

YOU CAN BAG NUTRONITE FOR LAWNS

Bag Nutronite to fill out your line of lawn and garden fertilizers. Golf courses use large quantities, too. For information on this profitable market for an all organic fertilizer write Smith-Rowland Co., Norfolk, Va.

Nutronite (formerly Smirow) adds to the selling power of your mixed fertilizers. Plainly visible Nutronite assures your customers of added growth and profits . . . brings back satisfied customers year after year.

Nutronite is the 100 percent natural organic addition to mixed fertilizers. Its nitrogen is 90% water insoluble and 90% available—for that all-season effect on plant growth.

Nutrition + Nitrogen = Nutronite

Let us figure the cost of Nutronite delivered to your plant.

SMITH NUTRONITE ROWLAND

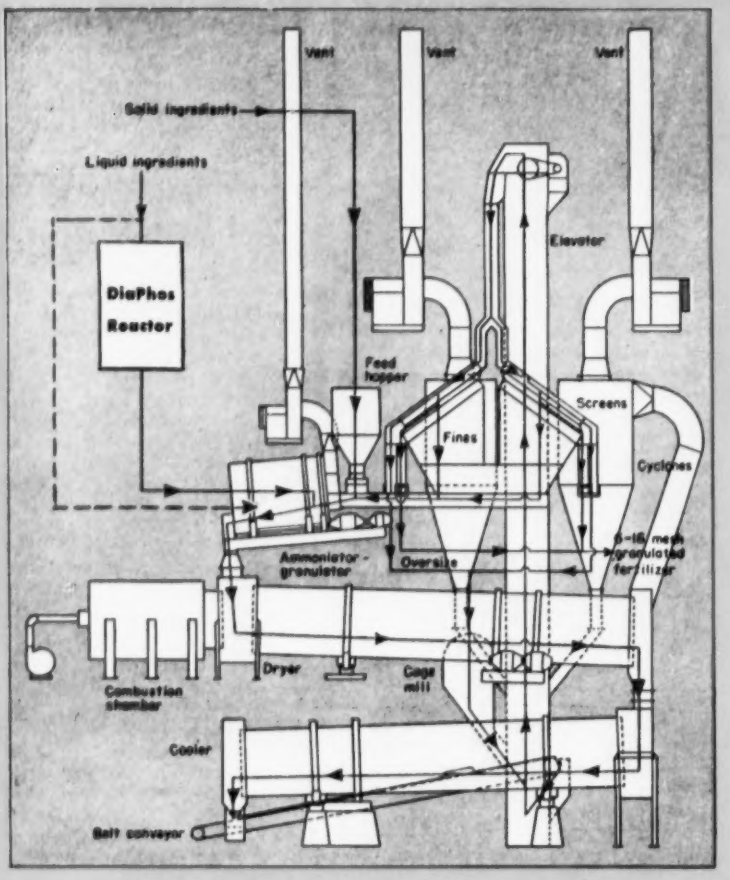
SMITH-ROWLAND CO.

P. O. Box 1219, Norfolk 1, Va.

A DIVISION OF SMITH DOUGLASS COMPANY INCORPORATED

NEW

WEATHERLY DiaPhos PROCESS



The flow sheet shows how simple this plant is, how easily existing plants can be converted, and how you can switch at will to any form of fertilizer.

ECONOMICAL FOR SMALL AND LARGE FERTILIZER PLANTS

The demand for Water Soluble fertilizer has become so important that we have developed the new Weatherly *DiaPhos* Process to meet the need at low installation and operating cost.

It can readily be added to existing plants or built into new plants. It is the most completely flexible fertilizer production equipment. It will deliver:

1. **WATER SOLUBLE ammonium phosphate, containing up to 72 units of plant food from phosphoric acid and other liquid and solid materials.**
2. **GRANULATED, by the thoroughly proven Weatherly process for production of closely size-controlled granules.**
3. **POWDERED. This plant will, of course, also produce non-caking, free-flowing powdered fertilizer, using the lowest cost raw materials.**

No other process has this flexibility

The D. M. WEATHERLY COMPANY

Industrial Engineers and Builders

80 Eleventh St., N.E., Atlanta, Georgia Phone: TRinity 5-7986

Published Monthly by
WALTER W. BROWN PUBLISHING CO., INC.
75 Third St., N. W., Atlanta 8, Ga.
Phone TRinity 4-4160

President
ERNEST H. ABERNETHY

Editor
BRUCE MORAN

Managing Editor
CLAY W. PENICK, JR.

Business Manager
V. T. CRENSHAW

Chicago Representative
ELON A. ABERNETHY
1755 Howard St.—Room 200
Chicago 26, Illinois
Phone Rogers Park 4-5616

West Coast Representative
M. A. CALDWELL
2267 W. 24th St., Los Angeles, Cal.
Phone REPUBLIC 1-3050

Address all inquiries, advertising and editorial material, and correspondence to Atlanta Publishing Offices, sending direct to COMMERCIAL FERTILIZER and PLANT FOOD INDUSTRY, 75 Third St. N. W., Atlanta 8, Georgia.

Vol. 94 No. 1 *Established 1910* January, 1957

Commercial Fertilizer
and PLANT FOOD INDUSTRY

Subscription rates: United States, $3.00 per year; 5 years, $12.00. Foreign $5.00 per year.

Contents

Just Around the Corner, by *Vernon Mount* 10
1955-56 Fertilizer Consumption, by *W. S. Ritnour* 25
Research Results & Reports 26
Nitrogen for Direct Application, by *Adams and Scholl* 27
Industry Calendar 36
Economic Nitrogen Comparison, by *Heady and Baum* 39
Personals 55
Changes 56
Obituaries 56
Midwest Agronomist Meeting 63
Off-season Fertilizer Potentials, by *L. B. Nelson* 64
Crop Chemicals 66
Tonnage Report and Markets 68
Classified Advertising 69
Advertising Index 70

COMMERCIAL FERTILIZER and PLANT FOOD INDUSTRY, entered as second class matter, October 12, 1910, at the post office at Atlanta, under the Act of March 3, 1879. Published monthly except semi-monthly in September, by Walter W. Brown Publishing Co., Inc., 75 Third St., N. W., Atlanta 8, Georgia.

Commenting Freely

by Bruce Moran

It is a good thing farm income will be well up this year, as predicted by USDA, because the cost of running a farm is going up, too. And if the USDA prediction is right: that the farmer's net income will be up, too—he will have to make a pretty nice gross to come out.

Taxes, interest rates, wages, prices of farm machinery, motor vehicles and the like—all these are expected to be moderately higher.

The price of fertilizer, to continue with USDA's crystal ball department, is expected to average "slightly lower per ton of plant nutrients, but slightly higher per ton of gross weight."

There is a spot for salesmanship. High analysis fertilizer can be sold, even to the most conservative farmer—if the salesman is well informed—and competent to present the story of high analysis so as to overcome the farmer's fears. The more we sell plant food, instead of tonnage—the better off everybody will be, now and in the future.

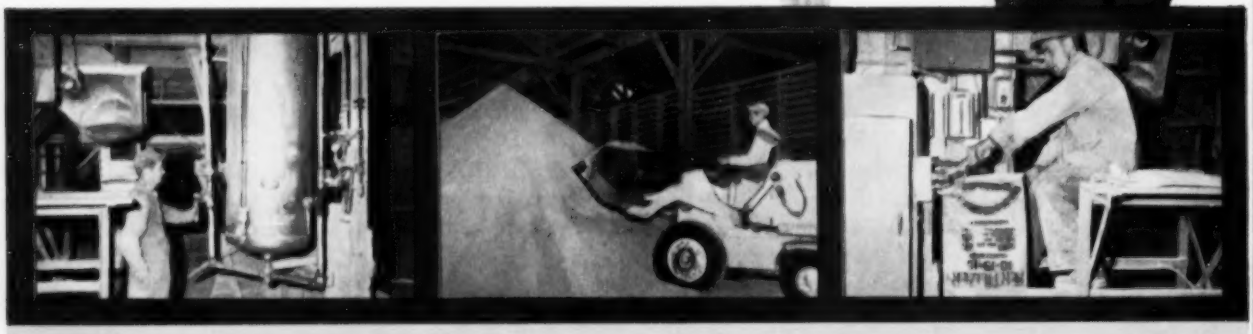
When we checked International's

"How to get an extra 212 lbs. of nitrogen solution in each ton of triple"

says Mr. W. R. Edgecomb, Treasurer and General Manager of the Aroostook Hi-Test Fertilizer Company, Presque Isle, Maine

With International's triple we use 666 lbs. of nitrogen solution* per ton, reports Edgecomb. With another triple, our ammoniation rate was only 454 lbs. of solution per ton.

*24.5% free NH_3; 56.0% Ammonium Nitrate; 10.0% Urea; 9.5% H_2O.



A calibrated measuring tank is the heart of Hi-Test's batch ammoniating system. Triple is ammoniated as it is unloaded from rail cars.

Superior ammoniation qualities make International's triple ideal for high analysis fertilizers. Complete ammoniation reduces chance of setting up.

The Hi-Test plant mixes four grades of high analysis fertilizers . . . all sold under the Hi-Test brand name. 80-pound bags are moved by conveyor.

ammoniation rate, we learned

Superior ammoniation qualities are important reasons why Mr. W. R. Edgecomb (left) and Mr. Harry W. Trask, Sales Manager, are satisfied users of International's triple super.

"WE LEARNED by experience. Our ammoniation rate proved that International's triple had the superior ammoniation qualities we were looking for," says W. R. Edgecomb, of the Aroostook Hi-Test Fertilizer Company.

"We ammoniate 1500 pounds of International's triple with 500 pounds of nitrogen solution. This gives us a base of 11.1% nitrogen and 35.2% A.P.A."

Compare these results with the ammoniation rate for the triple they previously used — 370 pounds of solution for each 1630 pounds of triple. It's easy to see why International's triple helps this Presque Isle, Maine, firm hold down formulation costs . . . why they are really sold on International.

From the time they receive the triple at their plant siding . . . this highly efficient fertilizer plant operates to take full advantage of the many savings offered by International.

First of all, water shipments to Searsport, Maine, help hold down the cost of the delivered goods. The triple is then shipped by rail to Presque Isle.

Then Aroostook ammoniates the triple from the track. The triple passes through a batch ammoniating system featuring a calibrated measuring tank.

This ammoniating procedure, says Edgecomb, gives them superior results and reduces the possibility of the ammoniated triple setting up. And in addition it gives the material a more desirable granular texture.

What's more, with International's triple they are able to unload a car of nitrogen solution in 1½ days . . . a saving of a full half day. This in turn helps avoid any extra demurrage charges.

This system enables Hi-Test to handle large shipments of triple during the slack season and save on freight. With four men working, they can ammoniate 90 tons of triple (121 tons of base goods) in a normal working day.

If you have not already tried International's superior product — the triple with a guaranteed constant minimum of 46% A.P.A. — put us to the test. You too will become a satisfied customer.

Write or wire International Minerals & Chemical Corporation for full information on prices, shipping and warehousing arrangements.

PHOSPHATE

CHEMICALS

DIVISION

MINERALS International CHEMICALS

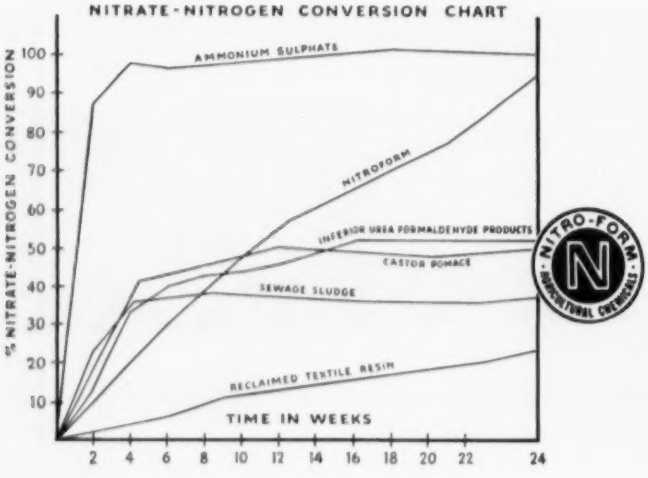
INTERNATIONAL MINERALS & CHEMICAL CORPORATION

General Offices: 20 North Wacker Drive, Chicago 6

More and More Specialty Fertilizer Manufacturers are using NITROFORM®

Nitroform has so many distinctive advantages it's no wonder more and more fertilizer manufacturers are using this solid Urea-Form in their mixes.

Don't be misled by other forms of urea-formaldehyde. Make sure that the Urea-Form you are using in specialty fertilizers passes the accepted A. I. test for nitrogen availability. Results count. The chart below illustrates the release of available nitrogen of Urea-Form in comparison with less desirable substitutes.



Why NITROFORM?

- it mixes easily . . . is now available in a colored granular or powder form.
- is clean, odorless, non-leaching and non-burning.
- is economical, and offers larger profits in mixed fertilizer sales.
- is field test proven . . . to meet specific nitrogen requirements of Urea-Form.

Write now and let us give you complete facts and figures on how NITROFORM can increase your sales and profits.

NITROFORM
AGRICULTURAL CHEMICALS, INC.
A DIVISION OF
Woonsocket Color & Chemical Co.
92 Sunnyside Ave. • Woonsocket, Rhode Island

Meet The Demand For High Analysis

Use

DAVISON'S

TRIPLE

Superphosphate

State Agricultural Experiment Stations and other authoritative sources are recommending fertilizers with ever increasing plant food units per ton. High analysis fertilizers are in demand because they give more for each fertilizer dollar. Meet this demand by incorporating Davison's New Triple Superphosphate in your formulation.

Davison's Triple Superphosphate has 45/46% available P_2O_5 and is supplied in the easy-to-use granulated form or run-of-pile.

Order Davison's Triple Superphosphate. For complete information, call or write.

Progress Through Chemistry

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, TRIPLE SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS AND SILICOFLUORIDES. SOLE PRODUCERS OF DAVCO® GRANULATED FERTILIZERS.

JUST AROUND THE CORNER *by Vernon Mount*

SLIDE RULES seem to frighten the youngsters. At least that seems to be the answer to the growing worry about shortages of well-trained scientific personnel. A study showed the kids thought it takes genius to be a scientist; that they do not lead normal family lives nor enjoy themselves; that scientists are odd, cold-blooded, even evil.

NO WONDER Russia is winning the race to train scientists needed so badly in this automatic world. It is a real danger for the future, when science-power will be many times more important than man-power, and brains will triumph over brawn—provided the brains have been trained properly.

WE HAD BETTER be doing something about correcting this odd feeling among the kids . . . another form of Junior Achievement, perhaps, or regular talks in the schools, or even some comic books on the subject.

Yours faithfully,

Vernon Mount

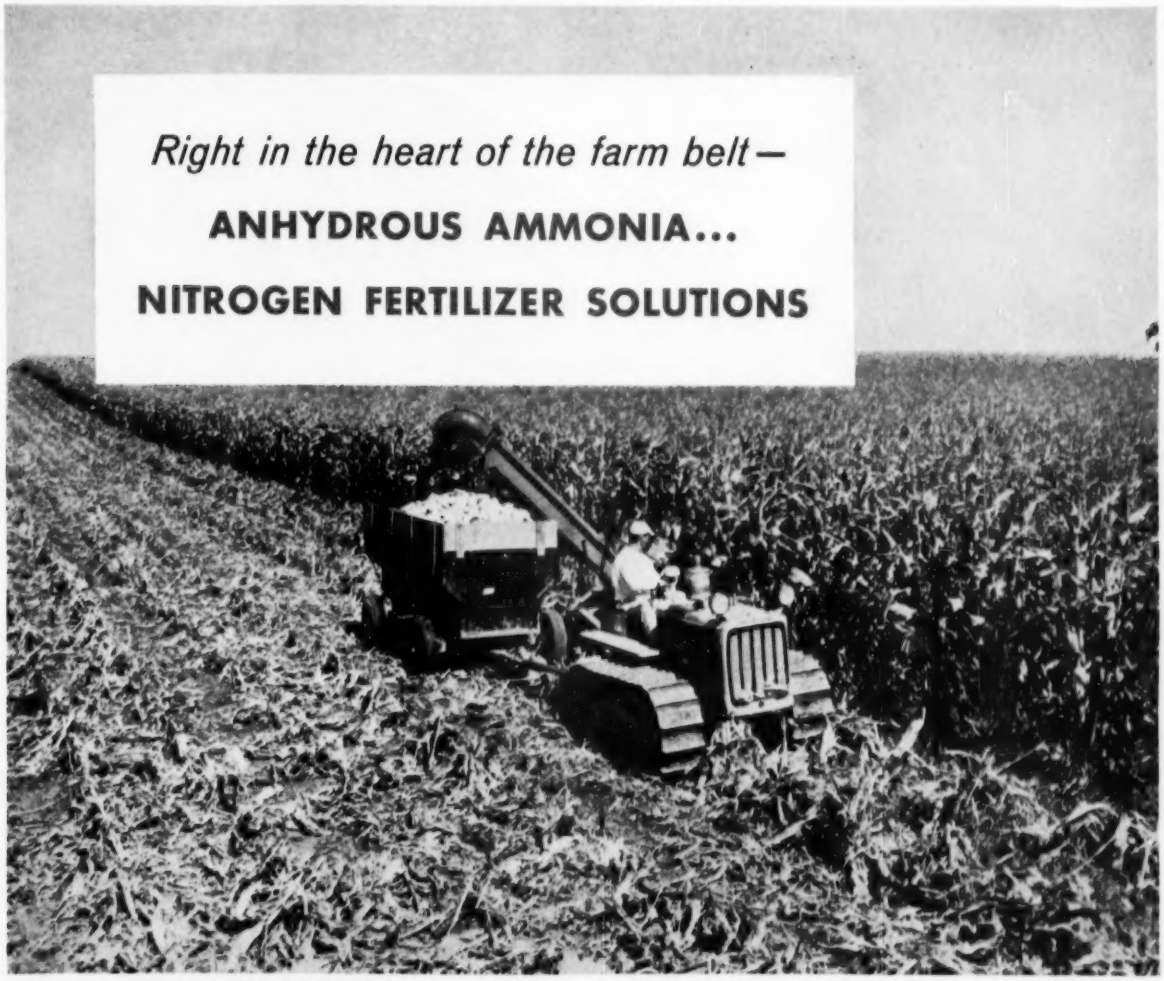
PACKAGE MORE SALES

Put more sales in your packaged product—
specify bags by Percy Kent.
PK's fresh, creative bag designs
and high technical standards of bag printing
dominate the displays in any dealer's store.

SINCE 1883

MULTIWALLS • COTTONS • BURLAPS
PERCY KENT BAG COMPANY, INC.
KANSAS CITY • MINNEAPOLIS • OKLAHOMA CITY
CHICAGO • BUFFALO • NEW YORK

Scratchboard drawing of our Kansas City plant . . . an excellent technique for bag printing. Do you like it?



Texaco builds new midwest source for fertilizer material

LOCKPORT, ILL.—A new, centrally located source for fertilizer raw materials—produced right in the middle of America's great farm belt—will become available when Texaco's new ammonia plant goes on stream at Lockport. The new facilities will produce anhydrous ammonia and nitrogen solutions for agricultural and industrial use.

Demand for dependable supplies of these chemical raw materials has grown steadily with the increased use of fertilizer nitrogen in our major farm areas. Texaco's new plant, served by central rail and tank truck facilities, will offer fertilizer manufacturers a stable source of supply and fast, reliable service.

☆ ☆ ☆

The Texas Company, *Petrochemical Sales Division*, 332 South Michigan Avenue, Chicago 4, Illinois, or 135 East 42nd Street, N. Y.

TEXACO **TEXACO** **PETROCHEMICALS**

Rip-p-p ...and it's open!

Bemis RIPP-NIPP* Bag

Grasp tape here

TO OPEN
Pull up Sharply!

Give your customers the time- and labor-saving benefits of Bemis RIPP-NIPP* in Bemis Multiwall Bags. They'll thank you for it... and RIPP-NIPP costs you nothing extra.

Get the details from your Bemis Man.

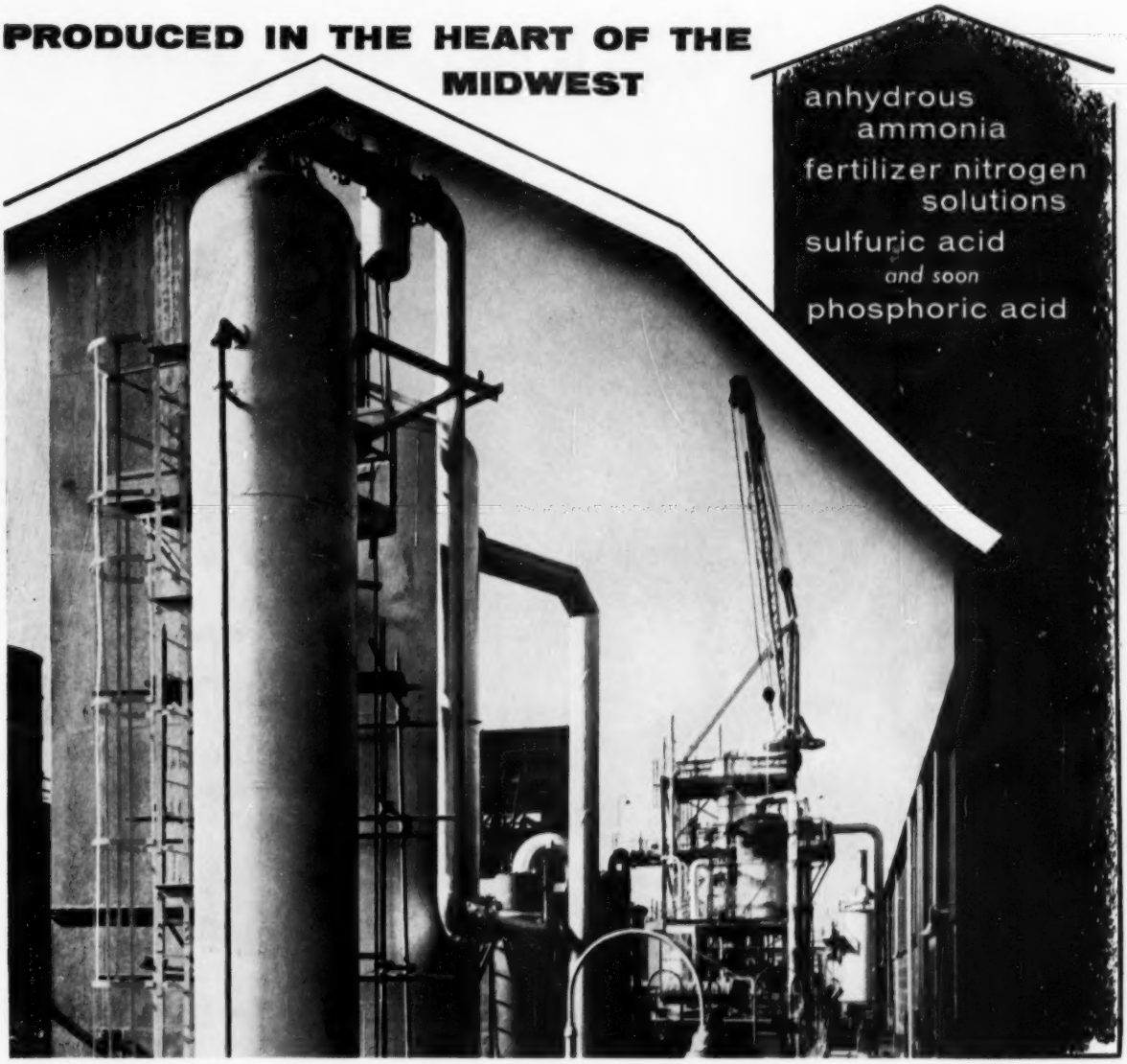
RIPP-NIPP—A small, closely controlled, machine-made nip cut in the bag at the edge near the sewn seam to start easy tear along the top. Does not weaken the bag.

*Trade-mark

Bemis

General Offices — St. Louis 2, Mo.
Sales Offices in Principal Cities

PRODUCED IN THE HEART OF THE MIDWEST



AT TUSCOLA, ILLINOIS – in the heart of the midwest farm area – U.S.I. produces a combination of agricultural chemical raw materials for fertilizer manufacturers.

Anhydrous Ammonia and Fertilizer Nitrogen Solutions From other U.S.I. affiliated plants at Tuscola, and from a natural gas reforming unit, hydrogen flows into the U.S.I. ammonia plant, where it is reacted with nitrogen to produce anhydrous ammonia and nitrogen solutions. Since the raw materials for this operation are produced internally, supply is steady, reliable and ample.

Sulfuric Acid U.S.I.'s 400 ton per day sulfuric acid plant produces all grades of virgin acids, including electrolytic and oleum, plus a good quality of process-spent acid suited to fertilizer manufacture. This plant operates year round, permitting U.S.I. to store during off-seasons for the large in-season agricultural demand. Other sulfuric acid plants are located at Dubuque, Iowa, and Sunflower, Kansas.

Phosphoric Acid U.S.I.'s new plant at Tuscola produces wet process phosphoric acid from phosphate rock and U.S.I.'s sulfuric acid. Design capacity is 30,000 tons of P_2O_5 shipped as 75% phosphoric acid.

In the midst of the midwest farm area – where fertilizer demand is high and moving steadily higher – U.S.I. provides a single source for a variety of fertilizer raw materials. This source is a flexible one, since it is part of the company's chemical producing center at Tuscola. Other materials can be made for long-range demands.

For further information, address your nearest U.S.I. office, or contact Chemical Sales, U.S. Industrial Chemicals Co., 99 Park Avenue, New York 16, N. Y.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

here's the Biggest News in the Fertilizer Industry

This revolutionary multi-wall is a real advancement in the science of bag closure. Unlike ordinary multi-wall pasted valve bags, the Arkell & Smiths "Step-Flex" Bag is triple-sealed top and bottom to eliminate sifting of fine materials. The plies forming the multi-wall construction are staggered on the ends, and each ply on one side of the bag is pasted to the corresponding ply that it overlaps on the opposite side of the bag . . . at both top and bottom.

This improved construction forms a positive sift-proof seal and actually makes the top and bottom of the bag even stronger than the walls!

Since the size of the orders for this new bag are increasing daily, we recommend that you let us know your requirements immediately! Write, wire or phone today.

P.S. There is no upcharge for the triple-sealed "Step-Flex" Bag.

Cement Chemicals Fertilizer

ARKELL AND SMITHS

Executive Offices: 500 Fifth Ave., New York 36

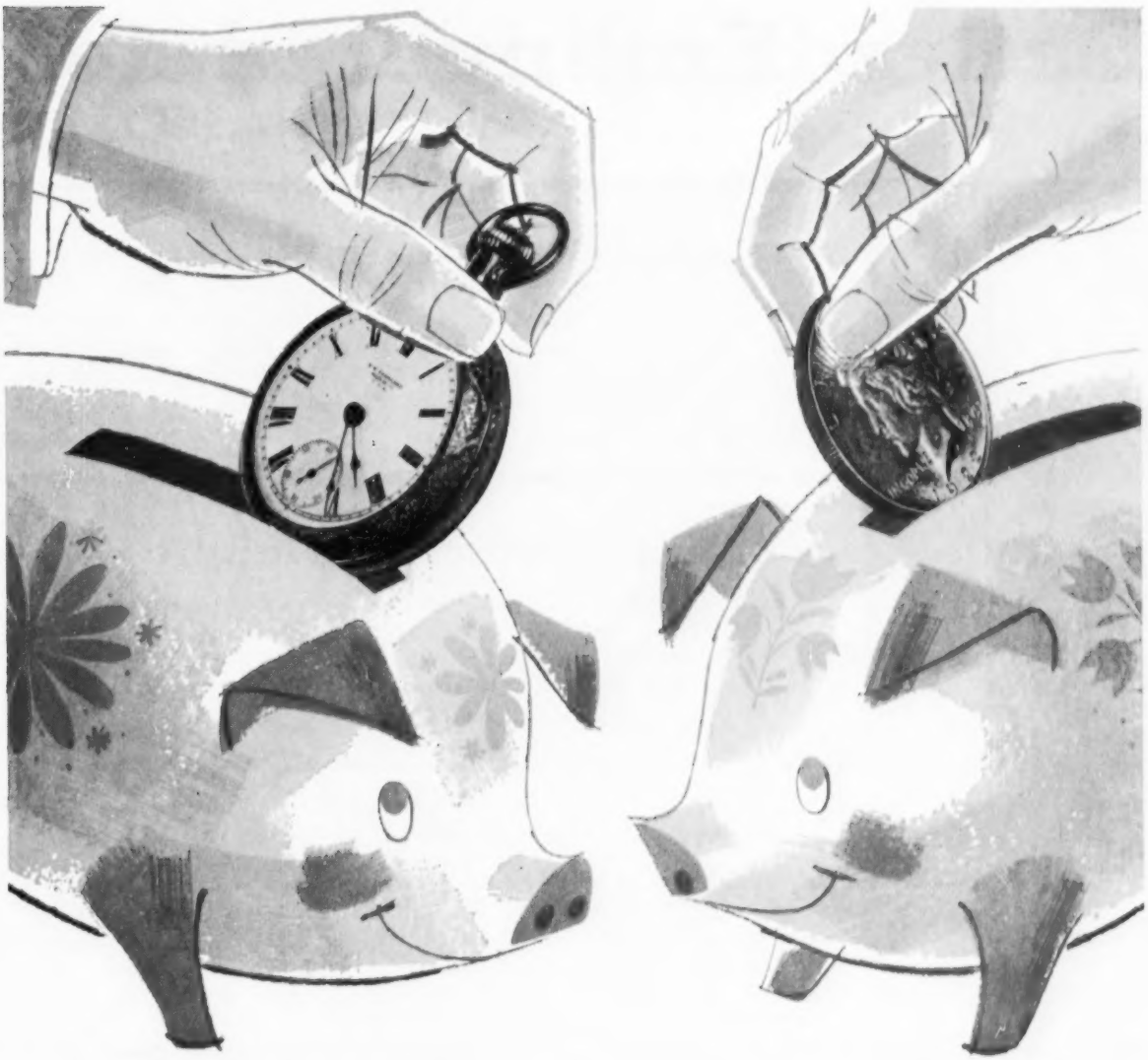
Manufacturing Plants at:

Canajoharie, N. Y. • Wellsburg, W. Va.
Mobile, Ala. • Hudson Falls, N. Y.

"The Oldest Name in Paper Bags"

Plaster Lime Clay Talc

FOR ADDITIONAL INFORMATION, WRITE TO ARKELL & SMITHS, PACKAGING DIVISION, CANAJOHARIE, NEW YORK



TIME IS MONEY... SAVE BOTH!

ORDER NITROGEN PRODUCTS FROM SINCLAIR NOW

There are two big reasons why you should sign now with Sinclair for your supplies of nitrogen solutions, anhydrous ammonia and aqua ammonia.

First – the completion and opening of a centrally-situated new plant in Hammond, Indiana, means substantial savings in delivery time and shipping costs for most Mid-West nitrogen users.

Second – your seasonal supply problem can be solved by this plant's vast storage capacity . . . products will be delivered when you need them to meet your production schedule.

Let Sinclair help you solve your nitrogen supply problems and save you time and money in the bargain. Phone or write . . .

SINCLAIR CHEMICALS, INC.

(Affiliate of Sinclair Refining Company)

600 Fifth Avenue, New York 20, N. Y. – Phone Circle 6-3600
155 North Wacker Drive, Chicago 6, Illinois – Phone Financial 6-5900

Better Engineered for

Shortest Turning Radius

The model HA can work where others can't because it has a shorter turning radius than any comparable tractor-shovel — can go through narrow doorways and between spaces less than 4½ feet wide. With a turning radius of only 6 feet 3½ inches it easily turns corners of 6 foot aisles.

Higher Dumping Height

This "PAYLOADER" can deliver its loads over bin or hopper edges up to 6½ feet high. The bucket in maximum dump position can clear heights of 5 feet 2½ inches with a forward reach of more than 2 feet beyond front of machine. Loads can be dumped as fast or slow as desired, and at any height.

Biggest Capacity (18 cu. ft. payload)

With a bucket capacity of 18 cu. ft. payload and 14 cu. ft. struck the model HA has a carrying capacity up to 25% greater than all comparative machines and even more than some bigger, heavier machines. Better engineering including the exclusive 40° bucket tip-back action are the reasons the model HA handles more tons per load and more loads per hour.

Easiest Operating

The entire hydraulic control of the model HA bucket — tip-back, raise, dump, lower — is handled by a single conveniently located lever. It's the simplest, easiest bucket control available. Smooth hydraulic brakes, full anti-friction steering mechanism and torque-converter drive makes the model HA easy to operate at high output rates the full shift.

Processing and manufacturing plants of all kinds report that the new model "PAYLOADER" tractor-shovels are not only a great improvement over earlier models but are also way ahead of other front-end loaders in design and productivity — can handle more tons of material per hour than heavier machines with larger engines. The exclusive 40 degree break-out and tip-back of the bucket at ground level gets and holds big loads close and low without spilling. Hydraulic load-shock-absorber smooths the ride and permits higher travel speeds. The low-mounted boom arm design makes operation faster, safer and easier because driver cannot get caught in mechanism and his line of vision is clear. Greater versatility is another valuable feature for many owners who use the floor-sweeper, fork lift, pusher forks and other available attachments that help make the model HA one of the most profitable machines any plant can own.

Unequaled Production

Owners *expect* more from a "PAYLOADER" and they *get* more because more "PAYLOADER" units have been built and are in service than all other wheeled tractor-shovels combined. Your "PAYLOADER" Distributor is ready to demonstrate a model HA, or a larger model from the complete "PAYLOADER" line.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO.
702 Sunnyside Ave., Libertyville, Ill.
Send data on "PAYLOADER" tractor-shovels

☐ **Model HA (18 cu. ft.) and HAH (1 cu. yd.)**
☐ **Larger models up to 2¼ cu. yd.**

Name _____
Title _____
Company _____
Street _____
City _____
State _____
19

MURIATE OF POTASH for the PLANT FOOD INDUSTRY

THIS symbol stands for high-grade coarse and uniform Muriate of Potash (60% K_2O minimum). Southwest Potash Corporation provides a dependable supply of HIGH-K* Muriate for the plant food industry.

*Trade Mark

Southwest Potash Corporation

NPFI Fights Freight Increase

We have reviewed the thick file of testimony presented at the hearings held by the Interstate Commerce Commission in late November and early December, which includes the testimony given by the National Plant Food Institute, refuting the claim of the railroads that rates should be higher. The Eastern and Western roads want the ICC to impose a 7% increase "on an emergency basis." These increases would apply to fertilizer and fertilizer materials.

The testimony by several NPFI representatives consisted of a thorough analysis of the long hauls required to bring fertilizer materials to the point of processing and consumption. Thoughtful use was made of such facts as these: phosphate rock is a low-grade form of traffic, requiring no special services; it originates in most cases by the trainload—hence must produce a high carload rate of return. Similar statements are made for potash, whose competitive position would directly be affected by any increase in transport cost. These are long-haul, heavy loading items.

Point was made of the fact that fertilizer prices to the farm have increased less percentagewise than any other commodity used on the farm, with the obvious inference, under present reduced farm income, that the cost rise which would be created by a freight-rate increase would react on the farmer's ability to use the fertilizer his land needs.

It is obvious that the full facilities of NPFI had been channelled into the preparation of this testimony, which is highly factual, and devastating in its logic.

10th Sou. Weed Conference

Program for the Tenth Annual Southern Weed Conference, January 23-25, Bon Air Hotel, Augusta, Georgia, was announced by W. B. Albert, president of the conference.

Leading authorities from Southern land-grant colleges, USDA, agricultural chemical manufacturers, farm equipment manufacturers and farmers from over the Southern states are expected to attend this important meeting.

Conference officers for this year in addition to Mr. Albert are: vice-president, E. G. Rodgers, University of Florida, Gainesville, Fla.; and secretary-treasurer, W. K. Porter, Louisiana Agricultural Experiment Station, Baton Rouge, La.

Arcadian® News

Volume 2 | For Manufacturers of Mixed Fertilizers | Number 1

NEW—FROM NITROGEN DIVISION

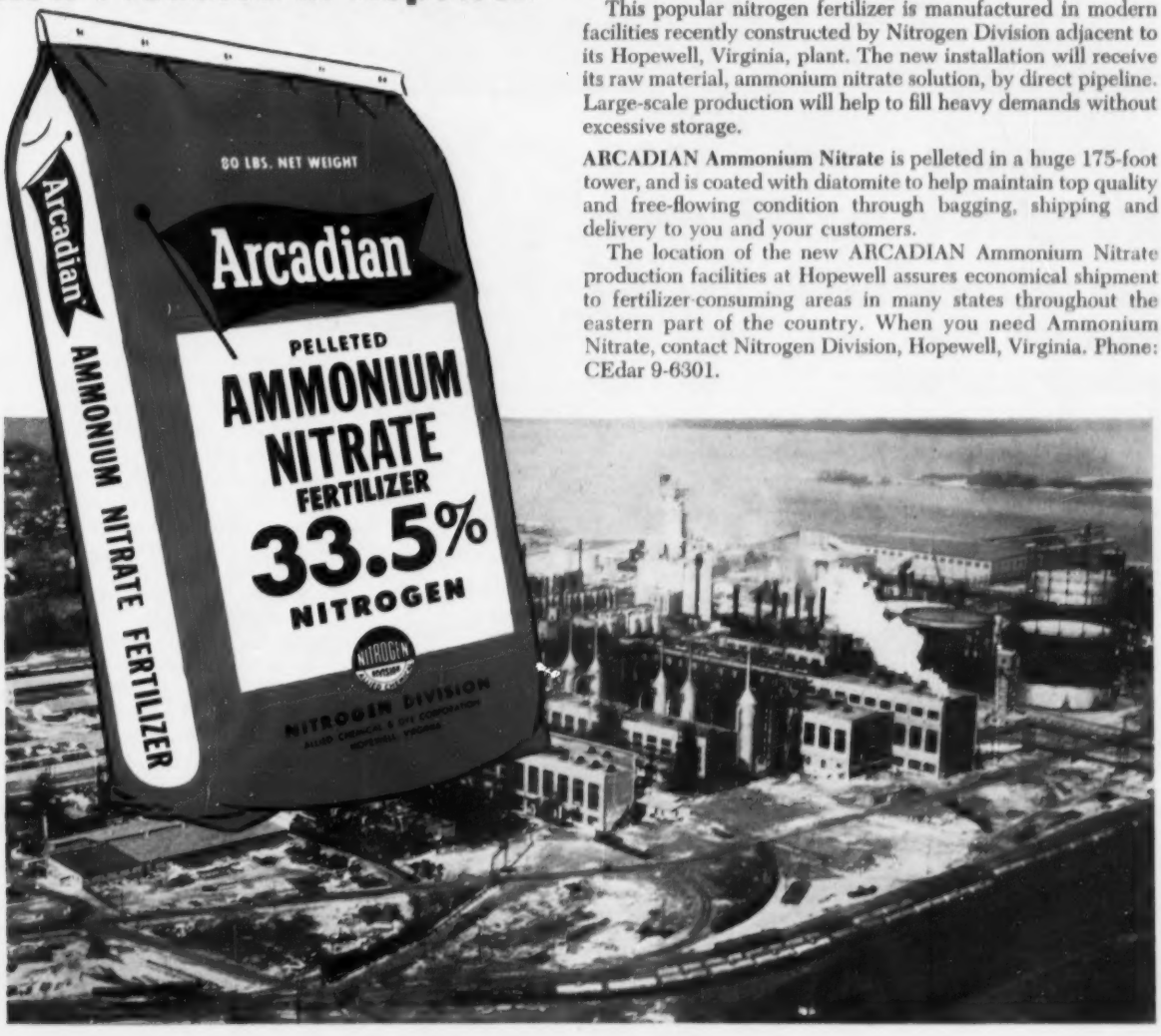
Pelleted Ammonium Nitrate Now Produced at Hopewell

ARCADIAN® Ammonium Nitrate, containing 33.5% nitrogen, is the latest addition to the complete line of nitrogen products now being supplied to the fertilizer industry by Nitrogen Division, Allied Chemical & Dye Corporation.

This popular nitrogen fertilizer is manufactured in modern facilities recently constructed by Nitrogen Division adjacent to its Hopewell, Virginia, plant. The new installation will receive its raw material, ammonium nitrate solution, by direct pipeline. Large-scale production will help to fill heavy demands without excessive storage.

ARCADIAN Ammonium Nitrate is pelleted in a huge 175-foot tower, and is coated with diatomite to help maintain top quality and free-flowing condition through bagging, shipping and delivery to you and your customers.

The location of the new ARCADIAN Ammonium Nitrate production facilities at Hopewell assures economical shipment to fertilizer-consuming areas in many states throughout the eastern part of the country. When you need Ammonium Nitrate, contact Nitrogen Division, Hopewell, Virginia. Phone: CEdar 9-6301.



Arcadian News for Fertilizer Manufacturers . . . . . from NITROGEN DIVISION

Air Blast Guns Speed Roadside Fertilization

FAST, LOW-COST SPREADING OPENS NEW MARKETS IN HIGHWAY DEPARTMENTS

Air blasting pelleted fertilizer onto roadside turf is the new, labor-saving, low-cost way to fertilize grass for erosion control and improved appearance of rights-of-way. Two men with two guns and an air compressor, in addition to truck and driver, are all it takes to spread granular fertilizer this easy way.

Using the newest method, fertilizer bags are loaded in one layer. Each man stabs a bag at a time with a special point attached to a hose leading to the gun, points the gun at the roadside, and turns on the air pressure to blow the fertilizer onto the turf. There is no heavy work dumping bags, or even opening them. And no heavy water tank for liquefying the fertilizer needs to be filled and hauled.

Adapted from sand-blasting equipment, the guns are now in use by several highway departments. Early models of air blast guns required the men to open the bags. With the newest designs, the men just stab the bags and shoot!

Greater sales of pelleted and granular fertilizer to highway and turnpike authorities can now be expected. It will pay you to see your local highway officials. The present road network, plus 41,000 miles of federal highways now being planned, provide a big market.

This two-man highway crew is preparing to fertilize roadside turf with the help of new air blast guns.

Once over doesn't end the market, since roadside turf needs steady maintenance. In Maryland, where roadsides have been fertilized for some time, officials figure that fertilizer is needed every other year to keep turf in good condition.

Here's MORE SELL for your FERTILIZER

Now appearing in January issues of farm magazines, this powerful, full-page, two-color advertisement emphasizes your strongest sales point to more than 3½ million farm magazine readers. It leads off the 1957 series of a continuing campaign conducted by Nitrogen Division in behalf of the entire fertilizer industry. Like previous ads, it points out that every acre produces more profit with more fertilizer.

It also shows how fertilizer cuts down the zooming costs for land, labor and machinery per bushel of crop yield. That's why fertilizer pays off for farmers even more than before. In all these advertisements, farmers are advised to "see your fertilizer dealer." Nitrogen Division would be pleased to hear your reactions to this service program, in order to make it work harder for *you*.

Bringing EXTRA ACRES to your farm

Every truckload of fertilizer you buy brings the crop-producing power of extra acres to your farm without the cost of extra land.

Take corn land, for example. When you use enough extra fertilizer to make 80 acres produce the yield 120 acres would ordinarily produce, it's like adding 40 acres to your farm without costs for land, taxes, labor, machinery, seed and insecticides.

You invest more in fertilizer, but you greatly reduce per-bushel production costs. Here's how it works, based on actual results on good corn land in 1956:

$600 worth of fertilizer
produced **8,580 bushels** on **120 acres.**

$1,640 worth of fertilizer
produced **8,480 bushels** on **80 acres.**

All costs, including fertilizer, for the 120 acres were $7,040 and $6,336 for the 80 acres. With corn at $1.10 per bushel, the 80 acres produced approximately the same yield and $594 more profit than the 120 acres.

Fertilizer costs a lot less than land. More fertilizer per acre can help you produce your usual total yield of corn on fewer acres at greater profit, enabling you to put more land into the soil bank or other crops. This makes dollars and *sense*. Get the advice of your county agent and your fertilizer dealer.

NITROGEN DIVISION ALLIED CHEMICAL

The fertilizer industry serves the farmer. Nitrogen Division serves the fertilizer industry as America's leading supplier of nitrogen, the growth element in mixed fertilizers. Nitrogen Division, Allied Chemical & Dye Corporation, 40 Rector St., New York 6, N.Y.

Fertilizer Grows Farm Profits

Greater Use of Fertilizers Builds Bigger Crop Profits from Irrigation

The farmer who digs an irrigation well or who starts pumping water from streams or ponds is a good prospect for more fertilizer. And irrigation is growing fast, even in the so-called humid Eastern states, according to the Agricultural Research Service of the U. S. Department of Agriculture.

Most years irrigated crops out-yield dryland crops by a big margin. Even in areas where rainfall is enough to mature good crops the better timing of irrigation often increases yields. Naturally, it takes more plant food to produce these bigger yields consistently. Good farming calls for a greater tonnage of fertilizer when irrigation water is available.

Farmers now water 30 million acres of land per year—nearly one-tenth of the U. S. harvested crop acreage. Western states already irrigate a large fraction of the land for which water is available. Growth in the East is now rapid. In 1956 some states irrigated twice as many acres as the year before.

Pasture and grass irrigation takes the acreage lead in the East, while vegetable crops show the greatest income increase per acre. Tobacco irrigation in North Carolina has doubled each year since 1951.

The more water available, the more fertilizer crops can use effectively. As irrigation grows, it builds concentrated fertilizer markets.

Fertilizer Rejuvenates Corn Land Unfertilized For Seventy-Eight Years

Good soil worn down to 29-bushel corn yields by 80 years of continuous cropping without fertilizer got a new lease on life with the addition of plant food in 1955-56. This is the report of University of Illinois agronomists on the famed Morrow plots—the nation's oldest soil experiment test.

Since 1876, the check plot received no fertilizer. Yield was 29 bushels per acre in 1956, and averaged only 22 bushels from 1944 to 1955.

Continuous corn unfertilized until 1955 and 1956, when it got heavy doses of lime, nitrogen, phosphorus and potash, yielded 113 bushels in 1956, and 86 bushels in dry 1955.

Not all run-down soils can be brought back fast, the Illinois agronomists point out. These plots were on originally deep, fertile soil that has kept some of its good physical condition.

Fertile Pasture Strips Make Better Fire Lanes

Well-grazed pasture strips make good, low-cost fire lanes in Southeastern woods. North Carolina uses 18-foot wide sod strips. A combination of legumes and grass, well-fertilized for a good stand, provides fine pasture and green, non-flammable cover. The sod also makes a good base for travel by fire-fighting equipment.

See Our TECHNICAL SERVICE Representative

for expert help on all your plant problems—skilled help based on more than 27 years of fertilizer experience. Our technical men's know-how is always available to customers.

Arcadian

Products for Fertilizer Manufacturers

Nitrogen Solutions:

URANA®
NITRANA®
U-A-S*
N-dure*

Other Nitrogen Products:

Anhydrous Ammonia
Urea Products
A-N-L®
Ammonium Nitrate
Sulphate of Ammonia
American Nitrate of Soda

*Trade-mark

NITROGEN DIVISION
Allied Chemical & Dye Corporation

40 Rector St., New York 6, N.Y.

Hopewell, Va.	Indianapolis 20, Ind.
Ironton, Ohio	Columbia 1, S. C.
Omaha 7, Neb.	Raleigh, N. C.
Columbia, Mo.	Atlanta 3, Ga.
Kalamazoo, Mich.	Los Angeles 5, Cal.
St. Paul 4, Minn.	San Francisco 4, Cal.

THE MAN WITH THE ★ MULTIWALL PLAN

UNION
PACKAGING SPECIALIST
DON DEININGER

saves Multiwall user $8 per M through specifications review

A Chemical Company, already using 43 different sizes and types of Multiwalls, planned to add new products to its line. Union Packaging Specialist Don Deininger recommended a simplification of Multiwall specifications and inventory. Union prepared a Specifications Manual for the manufacturer, also simplified, unified and modernized his bag designs.

Union Multiwall Recommendations are based on this 5-point Packaging Efficiency Plan

- DESIGN
- EQUIPMENT
- CONSTRUCTION
- SPECIFICATION CONTROL
- PLANT SURVEY

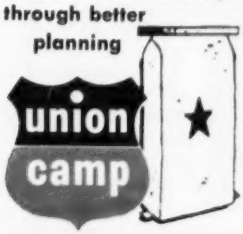
Results: user reported: (1) Union's recommendations for re-designing bag sizes and constructions in some instances saved as much as $8 per M.

(2) The new Specifications book enabled the customer to order bags more easily and accurately. It also simplified his inventory control.

(3) The new designs established a visual relationship between his family of products, enabled his sales force to do a better merchandising job.

This is a typical example of Union's 5-Point Multiwall Plan in action. Perhaps it can produce gains in your own Multiwall packaging operation. Write for additional information.

Better Multiwall performance through better planning



UNION'S PACKAGE ENGINEERING DEPARTMENT will study your Multiwall bagging methods and equipment and make appropriate recommendations, regardless of the brand of Multiwalls you are now using.

UNION MULTIWALL BAGS
UNION BAG - CAMP PAPER CORPORATION
233 BROADWAY, NEW YORK 7, N. Y.

OLD soils need NEW life!

revitalize them with–THE IRON CHELATE

PERMA GREEN IRON 135

for BIGGER, BETTER and FASTER-GROWING CROPS

UNTREATED

ORANGES

Four ounces to one pound PERMA GREEN IRON 135 per tree produces dark green leaves and more, larger and better colored oranges.

TREATED

When iron is lacking and plant leaves turn yellow, PERMA GREEN IRON 135 makes them dark green in two weeks' time.

PERMA GREEN IRON 135 is an organic chelate that moves upward with the sap to rejuvenate the entire plant.

PERMA GREEN IRON 135 *now produces –*

– healthier and more productive blueberry bushes
– larger and more beautiful roses
– deeper-green leaves on azaleas and rhododendrons
– more attractive ornamental trees and shrubs.
– more nutritious vegetables
– more and juicier oranges and grapefruit
– more and larger nuts

Write for detailed information on PERMA GREEN IRON 135 for plants and reprint of scientific article on CHELATES.

Developed by RESEARCH • Proved by PERFORMANCE

for quality products, remember –

Refined PRODUCTS CORPORATION

Manufacturing Chemists • 632 Schuyler Ave. • Lyndhurst, N. J.

SUNFLOWERS

Grown in nutrient solution. Small yellow plant at left treated with iron sulphate.

Large dark green plant at right treated with PERMA GREEN IRON 135.

GARDENIAS (Greenhouse)

Iron is very important for gardenias. Treat each bush with 1/16 to 1/8 level tablespoonful PERMA GREEN IRON 135 to insure dark green leaves and large pure white flowers.

FERTILIZER CONSUMPTION 1955—1956

by
WILLIAM S. RITNOUR, *Treasurer*
National Plant Food Institute

Consumption during 1955-56 was 4.4 percent less, tonnage-wise, than during the previous year. With the average plant nutrient content of commercial fertilizer still on the increase, total amount of plant nutrients consumed probably held its own-perhaps was greater than in 1954-55.

Fertilizer Consumption in The United States
1955-56 With Comparisons (Short Tons)

STATE	1953-54[1]	1954-55[1]	1955-56[2]
NEW ENGLAND	415,596	438,562	410,151
Maine	171,679	182,207	180,473
New Hampshire	15,767	18,408	16,015
Vermont	38,331	48,307	50,856
Massachusetts	84,560	84,972	73,664
Rhode Island	15,398	16,497	14,143
Connecticut	89,861	88,171	75,000[3]
MIDDLE ATLANTIC	1,567,579	1,619,009	1,469,536
New York	607,224	627,382	558,370[3]
New Jersey	289,508	285,184	250,054
Pennsylvania	670,847	706,443	661,112
EAST NORTH CENTRAL	4,202,676	4,107,640	3,897,121
Ohio	1,083,775	1,077,977	1,030,303
Indiana	1,153,229	1,133,883	1,048,658
Illinois	941,506	838,863	784,618
Michigan	596,034	634,976	626,529
Wisconsin	428,132	421,941	407,013
WEST NORTH CENTRAL	2,022,746	2,051,404	1,790,735
Minnesota	317,331	369,668	360,263
Iowa	628,663	568,314	433,931
Missouri	597,841	577,518	574,273
North Dakota	47,617	62,867	68,970
South Dakota	29,846	37,841	25,594
Nebraska	193,577	204,354	125,995
Kansas	207,871	230,842	201,709
SOUTH ATLANTIC	6,538,049	6,481,186	6,290,221
Delaware	94,655	95,462	82,097[3]
Maryland	310,581	315,563	296,629[3]
D. C.	2,695	2,793	2,868[3]
Virginia	779,173	793,395	761,215
West Virginia	76,685	81,568	84,660
North Carolina	1,822,442	1,799,541	1,646,965
South Carolina	936,865	924,829	859,118
Georgia	1,346,831	1,256,662	1,245,109
Florida	1,168,122	1,211,373	1,311,560
SOUTH CENTRAL	4,356,795	4,271,922	4,184,429
Kentucky	573,344	515,569	514,852
Tennessee	523,078	530,895	517,530
Alabama	1,179,030	1,156,530	1,054,266
Mississippi	727,920	718,367	750,305
Arkansas	368,091	332,513	358,800
Louisiana	314,424	318,802	296,655
Oklahoma	130,784	121,499	131,931
Texas	540,124	577,747	550,090
WESTERN	1,731,493	1,933,140	1,938,071
Montana	28,418	23,261	30,000[3]
Idaho	84,456	102,058	80,608
Wyoming	10,151	10,364	15,276[3]
Colorado	46,275	48,121	57,196
New Mexico	22,347	32,584	27,262
Arizona	134,320	152,279	134,085
Utah	28,104	27,612	23,339[3]
Nevada	3,414	1,804	3,096
Washington	154,052	184,502	153,492
Oregon	132,422	154,908	154,062
California	1,087,534	1,195,647	1,259,654[4]
UNITED STATES	20,834,934	20,902,863	19,980,264

[1]Source: "Commercial Fertilizers, Consumption in the United States" 1953-54 and 1954-55 by Walter Scholl, Hilda M. Wallace and Esther I. Fox, Fertilizer and Agricultural Lime Section, Soil and Water Conservation Research Branch, Agricultural Research Service, USDA.
[2]Preliminary, subject to revision.
[3]Estimated; margin of error may be large.
[4]Includes an estimated 225,000 tons of manures not reported by State.

Fertilizer consumption in the United States during the year ended June 30, 1956, is estimated to have been 19,980,264 tons. This includes ACP and TVA farm test demonstration distribution, but is exclusive of limestone, phosphate rock, colloidal phosphate, secondary and trace elements, gypsum, sulfur and other soil amendments. This figure of 19,980,264 tons for 1955-56 is a little less than a million tons under comparable 1954-55 figures taken from the U. S. Department of Agriculture report on fertilizer consumption, a decrease of 4.41 percent.

Although 1955-56 tonnage was down from the preceding year, preliminary estimates indicate that U. S. total consumption of primary nutrients probably was as great or greater than in 1954-55.

The average nutrient content in a ton of fertilizer sold in the continental United States has continued its upward trend. In 1939 it was 20.3 percent. In 1954-55 it was 27.9 percent. For 1955-56 it probably will be just under 29 percent.

The greatest percentage decrease tonnage-wise is in the West North Central States, a drought area. The decrease in this area amounted to 12.71 percent. Only the western States recorded an increase in 1955-56, and this was only a scant quarter of one percent. Twelve individual States and the District of Columbia showed 1955-56 increases over 1954-55, however. These States were Arkansas, California, Colorado, District of Columbia, Florida, Mississippi, Montana, Nevada, North Dakota, Oklahoma, Vermont, West Virginia, and Wyoming.

The largest percentage of increase by any one State was recorded by Nevada, with 71.62 percent. Even so, 1955-56 tonnage of that State was less than in 1953-54. The largest percent of decrease by any one State

Reprinted from PLANT FOOD REVIEW, a publication of the National Plant Food Institute.

was in drought stricken Nebraska, with 38.34 percent.

Fertilizer consumption in each of seven States exceeded one million tons and accounted for a total of 8.5 million tons: North Carolina, 1,646,965; Florida, 1,311,560; California, 1,259,654; Georgia, 1,245,109; Alabama, 1,054,266; Indiana, 1,048,658; and Ohio, 1,030,303.

California continued its climb, moving up from fourth place in 1954-55 to third in 1955-56. Florida also jumped a notch from third to second replacing Georgia which dropped from second in 1954-55 to fourth in 1955-56. North Carolina, the perennial leader, retained its number one spot, and other States in the top seven also retained their previous year's ratings.

This report, compiled for the most part from figures supplied by State fertilizer control officials, roughly parallels the more comprehensive official USDA report on fertilizer consumption which is issued annually in the spring for the preceding fiscal year. Figures for 1953-54 and 1954-55 are derived from the USDA report, "Commercial Fertilizers, Consumption in the United States."

1955-56 FERTILIZER CONSUMPTION IN THE UNITED STATES, WITH COMPARISONS[1] (Short Tons)

REGION	1954-55[2]	1955-56[3]	PERCENT CHANGE
New England	438,562	410,151	— 6.48
Middle Atlantic	1,619,009	1,469,536	— 9.23
East North Central	4,107,640	3,897,121	— 5.13
West North Central	2,051,404	1,790,735	—12.71
South Atlantic	6,481,186	6,290,221	— 2.95
South Central	4,271,922	4,184,429	— 2.05
Western	1,933,140	1,938,071	+ .26
UNITED STATES	20,902,853	19,980,264	— 4.41

[1]After deleting limestone, phosphate rock, colloidal phosphate, secondary and trace elements, gypsum, sulfur and other soil amendments.
[2]Source: "Commercial Fertilizers, Consumption in the United States, 1954-55," USDA.
[3]Prepared by NPFI. Preliminary, subject to revision.

RESEARCH RESULTS & REPORTS

US-Germany have concluded an agreement to swap experts and information in the field of agricultural research. Constant exchange of ideas and close cooperation between the two groups of scientists are expected to speed up the development of agriculture on both sides of the water.

O

Trees and their development as a crop come to us from all sides. Out in Oregon and Washington the soil bank is expected to result in 100,000 acres planted to trees. And various research projects now point to the likelihood that trees may some day be sprayed with fertilizer. They find sharply marked effects on trees through the use of nitrogen and phosphorus in generous quantities.

Over in Germany they are reviving the biogenic cycle in degraded forest stands with anhydrous ammonia.

Dr. E. D. Crittenden, Nitrogen Division's director of research, also sends us a report on German results, where nursery yields have jumped as much as 400% through fertilizer, and forest tree yields have been upped as much as 250%. A complete report on all this has been translated, and Dr. Crittenden will be glad to send you one without charge if you write him, Nitrogen Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

O

Stauffer has been granted a patent on a unique temporary soil sterilizing technique, involving their Vapam. This forms a volatile fumigant which kills weeds, weed seeds, fungi, nematodes and other pests—but within a few days decomposes into completely harmless compounds. So the soil is ready for planting, freed of harmful organisms, but ready to grow crops.

O

Fruit bombarded with atoms has been improved by the process. In fact, it seems from a New York AES report that the operation has harmed the fruit. But, nothing daunted, the boys at the Brookhaven National Laboratories as well as at the Experiment Station believe they are on the track of important things in the way of hereditary changes. They are hoping radiation exposure will cause more "sports" which will be useful in fruit breeding.

O

Cancer research may be moved forward by use of a weed killer, the University of California reports. It seems that amino-triazole has the same effect as cancer on the body enzyme known as catalase. So the bio-chemistry of cancer is advanced by the opportunity to study the effects of cancer, without introducing the Great Killer itself.

O

Drought research has been granted a $10,800 budget in Texas. The study will look into what makes the rain to fall, and what makes it not. Meanwhile they sternly say that promiscuous cloud seeding should not be permitted to get in the way of the research—which hopes to bring rain-making into the respectable society of science.

O

Wheat has led all the rest of the crops in Kansas in response to fertilizer, the Kansas State College reports. And this has been true throughout the state, not in isolated areas, and in all sorts of climatic variations. 50 pounds of N per acre, for example, will add four bushels to the yield in some circumstances —but 25 pounds is enough in the southern part of the Great Plains where nitrogen deficiency is not so marked. Average increase from N applications, whether applied at seeding time or as late as March 30, has been 12 bushels to the acre.

O

Plastic fertilizer hoppers, reinforced with fibre glass seem to eliminate the corrosion problem, according to Oklahoma Farm Research. From the same source comes a report that where a disc type applicator was used, cotton came up in more uniform stands than when a furrow-type applicator was employed . . . and turned out to be better suited to mechanical harvesting, and supplied increased yields.

O

Fritted trace elements seem to be doing a job. For example, one William Beal in New Jersey got 30% more potatoes per row where he used FTE, and his corn yield was "far superior" where FTE was applied.

O

Alfalfa in Tennessee responded to muriate of potash and borax like this: 27% in 1953, 37% in 1954, 52% in 1955—these increases being the average of more than 300 tests.

NITROGEN FERTILIZER MATERIALS FOR DIRECT APPLICATION

by

J. Richard Adams and Walter Scholl
Fertilizer and Agricultural Lime Section
Soil and Water Conservation Research Branch
Agricultural Research Service
U. S. Department of Agriculture
Beltsville, Maryland

Introduction

Fertilizer consumption in the United States and Territories showed an annual increase in tonnage from the termination of World War II to the fiscal year ended June 30, 1953, except in 1950, when there was a slight decrease. Consumption dropped again in 1954 and 1955. These changes in consumption were accompanied by a steadily increasing use of higher-analysis fertilizers. The average nutrient content of fertilizers supplying one or more of the primary plant nutrients—nitrogen, available phosphoric oxide, and potash—was 21 percent in 1946 and almost 28 percent in 1955. The use of these nutrients has increased annually since 1946. This is true even for those years when the total consumption of fertilizer declined and was due to the trend in using fertilizers of higher nutrient content. Nitrogen showed the greatest increase in consumption. The use of nitrogen almost tripled over this 10-year period.

Use of Nitrogen in the United States and Territories

Commercial nitrogen is supplied the farmer in the form of fertilizer materials and mixtures. The materials are products containing one or more plant nutrients. They can be applied directly to the soil, or used in the preparation of mixed fertilizers. When applied to the soil, they are often classed as simples, separate materials, or direct-application materials to differentiate them from mixtures.

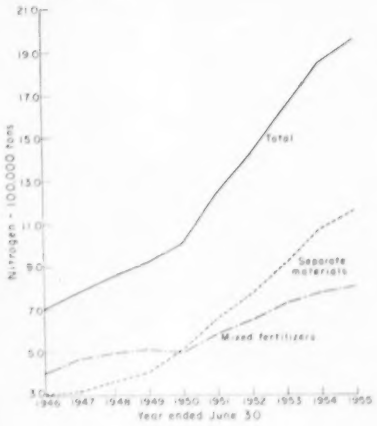
The form and amount of nitrogen applied to the soil has changed radically in the last 10 years. Less than half the fertilizer nitrogen was applied as separate materials in 1946, and by 1955 almost 60 percent was in this form (figure 1). The consumption of nitrogen in mixed fertilizers during the same period increased annually except in 1950, when there was a slight drop. The rate of increase was not as great as with the nitrogen in separate materials, and by 1950 the quantity used for direct application to the soil exceeded that in mixed fertilizers. The difference in the quantities used in these two forms has continued to widen since then.

Sources of Nitrogen for Direct Application

Direct-application nitrogen materials are used as supplements to mixed fertilizers or on soils or crops in need of a specific nutrient. Nitrogenous fertilizers in this category may be either solids, liquified gas, or aqueous solutions. Previous to the early 1930's all the commercial nitrogenous products used for this purpose were solid materials.

The solid nitrogenous materials customarily applied directly to the soil as such are chemical products except for the dried manures, which are used in considerable tonnage, and smaller quantities of other natural organics. The major products are ammonium nitrate, ammonium sulfate, and sodium nitrate. Other chemical materials are calcium cyanamide, calcium nitrate, urea, and the ammonium phosphates. Urea (45 percent nitrogen) and ammonium nitrate (33.5 percent nitrogen) are the most concentrated solid nitrogenous fertilizer materials. Ammonium nitrate is often sold in the form of ammonium nitrate-limestone mixtures containing 20.5 percent nitrogen. The limestone in these mixtures is sufficient to overcome the acid-forming tendency of ammonium nitrate.

Figure 1. Consumption of nitrogen in the United States and Territories.



The only liquified gas used as a source of plant nutrients is anhydrous ammonia. This product contains 82 percent nitrogen and is the most concentrated nitrogenous fertilizer. It exerts a presure of 211 p.s.i. at 104° F. and is commonly called a high-pressure liquid in differentiation from the low-pressure and nonpressure solutions. Anhydrous ammonia was first used commercially as a direct-application material early in the 1930's. This use was confined almost exclusively to the West Coast until after World War II. The increased use since then is due to the large supplies of ammonia and the price of a unit of nitrogen in this form. Nitrogen solutions also came into use to help satisfy the mounting demand for separate materials containing nitrogen.

The low-pressure solutions are aqueous solutions of ammonia alone (aqua ammonia) or in combination with ammonium nitrate or urea. The nitrogen content of these solutions varies from about 25 to 41 percent. The solutions usually have vapor pressures of less than 25 p.s.i. at 104° F.

The nonpressure types of solutions exhibit no appreciable vapor pressure and comprise aqueous solutions of ammonium nitrate alone or in combination with urea or sodium nitrate. They contain from 16 to 32 percent of nitrogen.

The low-pressure and nonpressure solutions, with the exception of aqua ammonia are commonly called nitrogen solutions. They are sold under various trade names which often indicate their nitrogen content and the products in solution.

Since 1946, the greatest tonnage of direct-application nitrogen has been supplied by ammonium nitrate and ammonium nitrate-limestone mix-

THIS ADVERTISEMENT sells new Hi-D Ammonium Nitrate Fertilizer. It appears in February issues of *Capper's Farmer, The Progressive Farmer, Prairie Farmer, Farm & Ranch,* and *Florida Grower and Rancher.*

Farmers asked Question after Question about HI-D Ammonium Nitrate

Read the kind of down-to-earth questions that many farmers fired at us and you'll see why they decided to make Hi-D Ammonium Nitrate their first choice as a supplemental Nitrogen Source.

Q. What's this "Hi-D" and what's so new about it?

A. Hi-D stands for high density. Hi-D Ammonium Nitrate is a hard, dry fertilizer that's made by an exclusive, patented process. It's a denser product with the maximum moisture "squeezed" out of it before the granule is formed. There isn't another form of ammonium nitrate like it!

Q. What about storage?

A. Commercial Solvents Corporation guarantees that Hi-D Ammonium Nitrate will store well under normal conditions for one full year. And, by the way, that brings up another advantage of Hi-D. Being a denser, more compact material, it has less bulk, takes up less room in storage. 10 bags stack in the same space as 8 bags of other types of ammonium nitrate. That means you can get up to 25% more nitrogen in a normal hopper load.

Q. Well, how does this denser material perform in the spreader?

A. High density means a drier ammonium nitrate. And that means that Hi-D doesn't gum up, doesn't stick, clog, cake or bridge, even on soggy, steamy days.

Q. How does it spread? Hi-D looks different.

A. You're right, Hi-D *is* different. Note the controlled size and unique shape that assure smooth, even distribution in all types of spreading equipment under all field conditions. The beauty of it is that it really flows freely, spreads evenly and stays put!

Q. Doesn't this same high density make for slower action in the soil?

A. Absolutely not. Hi-D dissolves readily in soil moisture, goes to work fast. But as you probably know, Hi-D Ammonium Nitrate gives Two-Step Action. The guaranteed 33.5% N comes in two balanced "servings". You get 16.75% nitrate nitrogen that goes to work immediately for fast, vigorous starts, and 16.75% ammonia nitrogen for sustaining follow-up feeding. Interesting thing about Hi-D, it contains the kind of nitrogen in sodium nitrate *and* the kind in ammonium sulphate as well.

Q. It ought to be better than sodium nitrate and ammonium sulphate — it costs more per bag. What do you say about that?

A. No, no, it costs less! Sure, bag for bag it costs more, but you forget you're not buying bags, you're buying *N*. 100 pounds of Hi-D gives you as much nitrogen as 159 pounds of ammonium sulphate, gives you as much nitrogen as 209 pounds of sodium nitrate. Putting it another way, for 100 pounds of straight N you need over 600 pounds of soda, nearly 500 pounds of sulphate, *but only 298 pounds of Hi-D.*

Q. They say that ammonium nitrate is acid forming. Is Hi-D?

A. Acid forming is just another way of saying that growing crops remove calcium from the soil. Hi-D helps make big crops which take out more calcium than small crops. Of course, some products do include lime but it's an expensive way to get insufficient limestone. As you know, the lime in such products is only enough to neutralize the fertilizer. It's not sufficient to meet the important requirements of a sound, integrated liming program.

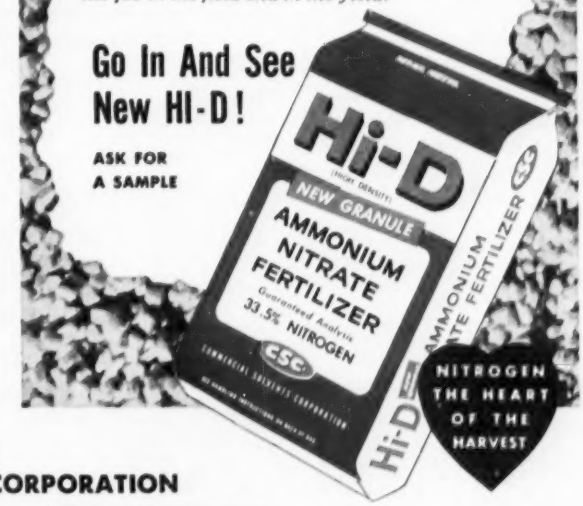
Q. Where does Hi-D fit in my fertilizer program?

A. Good question! It gives us a chance to stress mixed fertilizers. We don't sell mixed goods but we can't overemphasize their importance. Hi-D is not a substitute for mixed fertilizers. It's a supplement. Many crops take more nitrogen from the soil than can be put back readily in mixed fertilizers. The role of supplemental nitrogen is to satisfy this additional need. In many cases supplemental nitrogen is the lowest-cost way to get maximum profits. Hi-D Ammonium Nitrate is only one part of your program for lowering crop unit costs. You know better than we do that income goes down unless production per acre goes up. Fertile land is profitable land. Land fertility calls for soil testing, a liming program, the mixed fertilizer your dealer recommends – then, and only then, Hi-D Ammonium Nitrate as needed.

SEE YOUR DEALER. *Ask your dealer for a sample of this new high density material. Look for the GREEN & WHITE BAG. Put Hi-D to work this season. Test it side by side with any other nitrogen fertilizer you want to — on any crop, under any condition. You can trust Hi-D to do the job in the field and in the yield.*

Go In And See New HI-D!

ASK FOR A SAMPLE



CSC

a product of

COMMERCIAL SOLVENTS CORPORATION

7890 Folk Ave., St. Louis, Mo. and Terre Haute, Ind.
344 Williams St., N. W., Atlanta, Ga. and Sterlington, La.

CSC also produces BACIFERM® Bacitracin Antibiotic Supplements, and PEAK® Anti-freeze

tures (figure 2). Anhydrous ammonia occupies second place; it has been ahead of ammonium sulfate and sodium nitrate since 1948 and 1951, respectively. Consumption of anhydrous ammonia increased over 60 percent between 1953 and 1954, and by 1955 this material supplied almost two-thirds as much nitrogen as ammonium nitrate. Tonnages of nitrogen from ammonium sulfate, though relatively small in recent years, increased steadily from 1946 to 1954, after which there was a slight decrease. The use of sodium nitrate, erratic since 1946, showed an over-all decrease. Annual consumption data for nitrogen solutions (including aqua ammonia) previous to 1947 are not available, but since 1949 their use has increased each year and at an accelerated rate since 1953.

The changing picture of the portion of direct-application nitrogen supplied by the various materials is of special interest (figure 3). The portion of nitrogen in the form of ammonium nitrate ranged from 34 percent to almost 44 percent but followed a rather erratic course in doing so. Sodium nitrate supplied over 36 percent in 1946 and less than 9 percent in 1955. During the same period the nitrogen from ammonium sulfate dropped from a high of almost 15 percent in 1951 to a low of less than 10 percent in 1955. An additional 10 to 12 percent of nitrogen in solid form was supplied by calcium cyanamide, calcium nitrate, ammonium phosphates, and other nitrogen-bearing materials. While the percentage of direct-application nitrogen in solid forms was decreasing, the proportion from liquid sources was increasing. A little over a quarter of the nitrogen was supplied by anhydrous ammonia in 1955 compared with 7 percent in 1947. The increase was continuous from 1947 to 1954, after which there was a slight drop. At the same time, the portion supplied by nitrogen solutions, although still relatively small, has shown an accelerated increase since 1953 from approximately 2 percent to 7 percent in 1955.

Consumption of Anhydrous Ammonia in Direct Application

The U. S. Department of Agriculture first collected statistics on the consumption of ammonia for direct application in 1946-47, and the first published figure appeared in the 1947-48 fertilizer consumption survey. Prior to 1954 only national figures were published. For the first time, State figures were given for all regions in the 1954-55 fertilizer consumption survey and it is now possible to report State data for the proceeding years for all States except those in the Mountain and Pacific Regions. These data are shown in table 1.

Trends in regional consumption are shown in figure 4. In only 3 Regions—South Central, Mountain, and Pacific was anhydrous ammonia used for direct application prior to 1950. Use in the Mountain and Pacific Regions increased continuously up to 1955, except for a slight recession in 1949. Consumption in the South Central Region attained a peak of 103,846 tons of nitrogen from anhydrous ammonia in 1954.

Consumption of anhydrous ammonia for direct application in the North Central Region was first reported in 1950 and the only States in this region in which it was used at that time were Indiana, Iowa, Illinois, Missouri, and Kansas. Anhydrous ammonia has been used in all the States of this region since 1952. The increase in consumption in this region amounted to almost 600 percent between 1952 and 1954, with the greatest tonnage increases occurring in Illinois and Nebraska. Consumption of anhydrous ammonia in the North Central States exceeded that in any of the other regions in 1954, when it reached a peak of 105,427 tons of nitrogen.

The use of anhydrous ammonia for direct application has developed slowly in the eastern States. It was used first in the South Atlantic States in 1950 in Georgia and in 1951 in the Middle Atlantic Region in New Jersey and Maryland. In 1954, some anhydrous ammonia was being used in all the States of these 2 regions. Connecticut is the only New England State in which anhydrous ammonia has been used for direct application and there it has been used only since 1953 in token amounts.

In 1955, 290,337 tons of nitrogen in the form of anhydrous ammonia was used for direct application in the United States and Territories (table 1). This was 25.1 percent of all the nitrogen consumed in direct application. The largest tonnage used in any single State was 42,270 tons in California. This was 26.0

Figure 2. Consumption of nitrogenous materials in direct application in the United States and Territories.

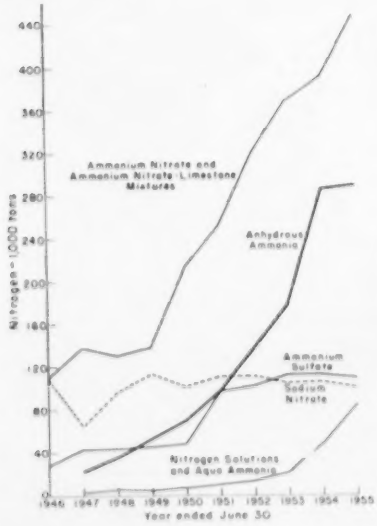


Figure 3. Relative distribution among selected materials of the total nitrogen used for direct application in the United States and Territories.

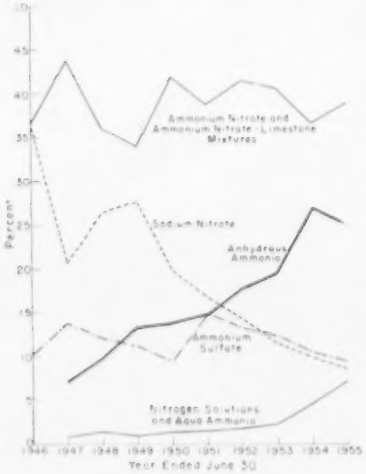
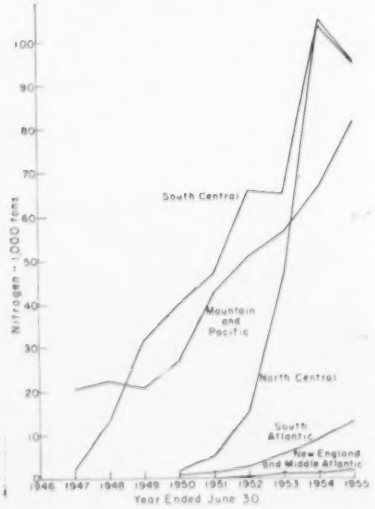


Figure 4. Nitrogen applied to the soil as anhydrous ammonia, by regions.



RIGID QUALITY CONTROL

TENNESSEE CORPORATION

TRIPLE SUPERPHOSPHATE

Fine Texture, Small Particle Size For Maximum Ammoniation-Granulation

Our thirty years' background of producing Triple Superphosphate gives us a know-how that is surpassed by none. Through our constant research program and our close relations with the fertilizer industry, we have maintained over the years, an exacting chemical and physical control program to insure that only the highest quality Triple Superphosphate will bear our label.

From the raw materials to the finished product, step-by-step in each process, rigid quality control is maintained to deliver to you a Triple Superphosphate of fine texture, small particle size, 46% available P_2O_5, natural air cured, pre-shipping conditioned, ready for immediate inclusion into your processing.

There's a **BRADLEY & BAKER** office near you. Their representative would be pleased to consult with you on your requirements and to advise on your most convenient delivery routings.

RIGID QUALITY CONTROL

Through Six Basic Chemical and Physical Analysis

HIGH WATER SOLUBILITY

High Water Solubility is a Characteristic of all 3 Grades

RUN-OF-PILE

Fine Texture, Highest Porosity, Large Surface Area, Small Particle Size, for Maximum Ammoniation-Granulation.

GRANULAR

Dust Free, Free Flowing, Uniform Particle Size, Medium Hardness, No Bridging Over, for Direct Soil Application.

COARSE

For Intermediate Ammoniation to Produce a Semi-Granular Product. Also Affords Excellent Compatable Mixing with Granular Potash, for Minimum Segregation, in Alkaline Grades.

U.S. PHOSPHORIC PRODUCTS

TAMPA, FLORIDA

Division TENNESSEE CORPORATION

SALES AGENT:

BRADLEY & BAKER

155 East 44th Street—New York 17, New York

DISTRICT SALES OFFICES:

Atlanta, Ga. Indianapolis, Ind. St. Louis, Mo. Norfolk, Va.

Table 1. Nitrogen applied to the soil as anhydrous ammonia, by States and Territories, years ended June 30, 1947-55[1]

STATE AND REGION	1947	1948	1949	1950	1951	1952	1953	1954	1955
	Tons N	Tons N	Tons N	Tons N	Tons N	Tons N	Tons N	Tons N	Tons N
Connecticut	-----	-----	-----	-----	-----	-----	5	2	11
NEW ENGLAND	-----	-----	-----	-----	-----	-----	5	2	11
New York	-----	-----	-----	-----	-----	-----	1	170	21
New Jersey	-----	-----	-----	-----	21	126	448	263	319
Pennsylvania	-----	-----	-----	-----	-----	-----	293	142	505
Delaware	-----	-----	-----	-----	-----	22	174	179	195
Maryland	-----	-----	-----	-----	7	167	140	371	524
West Virginia	-----	-----	-----	-----	-----	-----	-----	3	69
MIDDLE ATLANTIC	-----	-----	-----	-----	28	315	1,056	1,128	1,633
Virginia	-----	-----	-----	-----	113	43	383	270	668
North Carolina	-----	-----	-----	-----	-----	360	1,159	2,930	6,092
South Carolina	-----	-----	-----	-----	-----	-----	117	408	453
Georgia	-----	-----	-----	1,002	1,360	2,196	4,005	4,872	5,549
Florida	-----	-----	-----	-----	-----	151	0	572	371
SOUTH ATLANTIC	-----	-----	-----	1,002	1,473	2,750	5,664	9,052	13,133
Ohio	-----	-----	-----	-----	-----	895	1,789	2,388	2,479
Indiana	-----	-----	-----	20	168	521	1,358	7,090	8,734
Illinois	-----	-----	-----	43	1,065	3,973	16,408	23,582	14,215
Michigan	-----	-----	-----	-----	8	12	519	1,178	1,305
Wisconsin	-----	-----	-----	-----	-----	-----	558	1,597	2,311
EAST NORTH CENTRAL	-----	-----	-----	63	1,241	5,401	20,632	35,835	29,044
Minnesota	-----	-----	-----	-----	-----	-----	599	4,823	12,704
Iowa	-----	-----	-----	43	0	505	4,097	17,252	14,681
Missouri	-----	-----	-----	1,662	2,832	7,306	10,311	18,219	12,297
North Dakota	-----	-----	-----	-----	-----	-----	19	25	110
South Dakota	-----	-----	-----	-----	-----	-----	213	1,113	1,391
Nebraska	-----	-----	-----	-----	1,071	1,495	7,631	20,741	18,691
Kansas	-----	-----	-----	41	21	676	3,564	7,419	6,997
WEST NORTH CENTRAL	-----	-----	-----	1,746	3,924	9,982	26,434	69,592	66,871
Kentucky	-----	-----	-----	139	293	674	517	1,080	653
Tennessee	-----	43	1,037	2,800	1,478	3,211	2,802	5,386	3,754
Alabama	-----	-----	192	618	1,138	2,427	1,670	2,137	1,888
Mississippi	1,847	10,555	22,495	24,487	21,517	22,737	22,198	37,215	33,506
EAST SOUTH CENTRAL	1,847	10,598	23,724	28,044	24,426	29,049	27,187	45,818	39,801
Arkansas	-----	1,130	3,524	5,420	7,309	7,075	9,279	16,839	12,336
Louisiana	-----	1,458	5,415	6,409	12,024	15,703	13,140	18,946	19,504
Oklahoma	-----	-----	21	43	23	71	560	1,410	1,473
Texas	-----	-----	140	214	3,192	14,312	15,190	20,833	22,297
WEST SOUTH CENTRAL	-----	2,588	9,100	12,086	22,548	37,161	38,169	58,028	55,610
Montana	-----	-----	-----	-----	-----	-----	-----	-----	185
Idaho	-----	-----	-----	-----	-----	-----	-----	-----	3,251
Wyoming	-----	-----	-----	-----	-----	-----	-----	-----	169
Colorado	-----	-----	-----	-----	-----	-----	-----	-----	2,164
New Mexico	-----	-----	-----	-----	-----	-----	-----	-----	3,737
Arizona	-----	-----	-----	-----	-----	-----	-----	-----	8,162
Utah	-----	-----	-----	-----	-----	-----	-----	-----	1,375
Nevada	-----	-----	-----	-----	-----	-----	-----	-----	8
MOUNTAIN[2]/	[3]/	[3]/	[3]/	[3]/	[3]/	[3]/	[3]/	[3]/	19,051
Washington	-----	-----	-----	-----	-----	-----	-----	-----	15,015
Oregon	-----	-----	-----	-----	-----	-----	-----	-----	5,800
California	-----	-----	-----	-----	-----	-----	-----	-----	42,270
PACIFIC[2]/	20,550	22,370	20,961	27,176	43,057	51,245	56,788	67,120	63,085
CONTINENTAL U. S.	22,397	35,556	53,785	70,117	96,697	135,903	175,935	286,575	288,239
Hawaii	-----	-----	4	6	410	1,048	1,097	580	0
Puerto Rico	-----	-----	-----	-----	-----	1,032	1,042	0	2,098
TERRITORIES	-----	-----	4	6	410	2,080	2,139	580	2,098
TOTAL	22,397	35,556	53,789	70,123	97,107	137,983	178,074	[4]/ 287,155	290,337

[1]/ There was no reported consumption in States not shown.
[2]/ Individual State data are not given previous to 1955 to avoid divulging private business.
[3]/ Total included with the Pacific total.
[4]/ Revised.

percent of the total direct-application nitrogen used in the State. The next 4 States, in which anhydrous ammonia was used in decreasing quantities, were Mississippi, Texas, Louisiana, and Nebraska. The largest proportion of direct-application nitrogen applied in the individual States as anhydrous ammonia was in New Mexico, followed in decreasing order by Minnesota, Louisiana, Wisconsin, and Texas (figure 5). The largest tonnages of total direct-application nitrogen in 1955 were used in California, Mississippi, and North Carolina, and 26.0, 34.7, and 10.7 percent of the respective tonnages were from anhydrous ammonia.

Consumption of Nitrogen Solutions in Direct Application.

The annual consumption of nitrogen solutions, including aqua ammonia, is given in table 2 by States

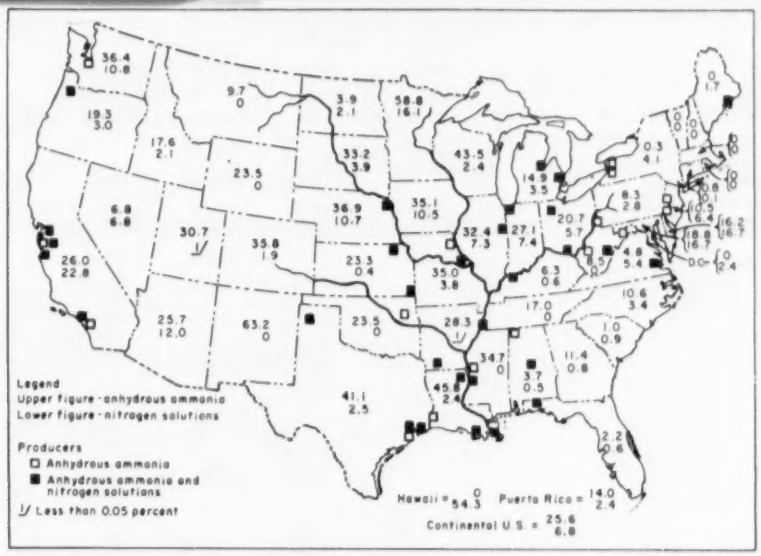

Legend
Upper figure - anhydrous ammonia
Lower figure - nitrogen solutions
Producers
Anhydrous ammonia
Anhydrous ammonia and nitrogen solutions
1/ Less than 0.05 percent
Hawaii = 0 / 54.3
Puerto Rico = 14.0 / 2.4
Continental U.S. = 25.6 / 6.8

Figure 5. Percentage of Direct Application Nitrogen Applied as Anhydrous Ammonia and as Nitrogen Solutions, Year Ending June 30, 1955 and Location of Producers, January 1, 1957.

and regions for the years ended June 30, 1947 through 1955. Fifty percent or more of the annual consumption has been in the Pacific Region every year except 1953 and 1954 and most of this use has been in California.

The percentage consumption pattern of nitrogen solutions is given in figure 5. The use of these solutions has developed more slowly than anhydrous ammonia use, but they accounted for a greater percentage of the nitrogen applied directly to the soil in Maine, New York, Delaware, District of Columbia, Virginia, and Hawaii in 1954-55 than anhydrous ammonia. In California, where their use is well established, they account for 22.8 percent of the total direct-application nitrogen compared to the 26.0 percent from anhydrous ammonia. Nitrogen solutions were not used in 1954-55 in New Hampshire, Vermont, Massachusetts, Rhode Island, West Virginia, Tennessee, Mississippi, Oklahoma, Montana, Wyoming, and New Mexico.

Primary Producers of Ammonia and Nitrogen Solutions.

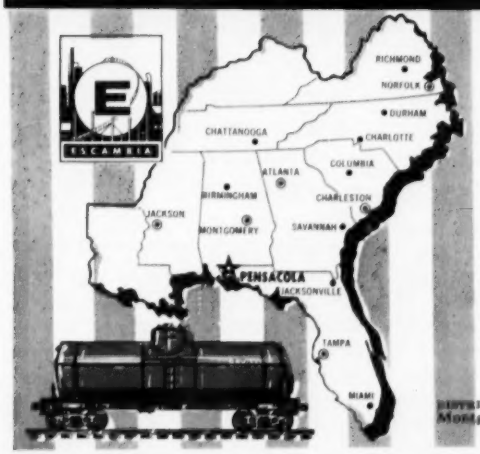
Previous to World War II there were only 9 domestic synthetic ammonia plants, with an estimated annual production capacity of 459,000 tons of ammonia, equivalent to 377,000 tons of nitrogen. These plants were located in California (3), Michigan (2), New York (2), Virginia (1), and West Virginia (1). The demand for fertilizers and explosives engendered by World War II necessitated the expansion of the industry, and the Government built 10 synthetic ammonia plants distributed in 9 States. Nine of these plants were leased or sold to private industry following the war and the other one, the plant of the Tennessee Valley Authority, is still operated by the Government. The total estimated capacity of these 10 plants plus the expanded capacity of the 9 privately owned plants was 1,700,000 tons of ammonia or 1,400,000 tons of nitrogen, by the end of the war.

Escambia Chemical, a Bright, New Name in Nitrogen

"BAY-SOL" NITROGEN SOLUTIONS

ANHYDROUS AMMONIA

AMMO-NITE AMMONIUM NITRATE FERTILIZER—33.5% NITROGEN



MORE IN SERVICE, MORE IN QUALITY

Technical service field representatives, to aid you with any problem, are as near as your telephone.

Modern, easily accessible manufacturing plant and continuing research.

Conveniently located service offices.

Strong supporting advertising in newspapers, farm magazines and other media.

Manufactured by

Escambia Chemical Corporation

Pensacola, Florida

Distributed Exclusively by

Ashcraft-Wilkinson Company

Atlanta, Georgia

DISTRICT OFFICES: Norfolk, Va., Charleston, S. C., Tampa, Fla., Jackson, Miss., Montgomery, Ala., Columbus, Ohio, Des Moines, Iowa.

Table 2. Nitrogen applied to the soil as nitrogen solutions, by States and Territories, Years ended June 30, 1947-55[1]

STATE AND REGION	1947	1948	1949	1950	1951	1952	1953	1954	1955
	Tons N	Tons N	Tons N	Tons N	Tons N	Tons N	Tons N	Tons N	Tons N
Maine									10
Connecticut									1
NEW ENGLAND									11
New York		48	0	0	0	0	24	136	311
New Jersey							42	108	194
Pennsylvania							22	60	172
Delaware						8	33	389	201
District of Columbia									1
Maryland							135	106	517
MIDDLE ATLANTIC		48	0	0	0	8	256	799	1,396
Virginia						20	93	15	744
North Carolina						70	300	1,047	1,960
South Carolina							41	107	401
Georgia						87	24	43	404
Florida		28	0	2	354	140	40	114	97
SOUTH ATLANTIC		28	0	2	354	317	498	1,326	3,606
Ohio						64	232	747	681
Indiana					14	518	1,369	1,930	2,394
Illinois						1,053	2,061	1,798	3,190
Michigan								101	308
Wisconsin							1	104	129
EAST NORTH CENTRAL					14	1,635	3,663	4,680	6,702
Minnesota							1,041	1,752	3,467
Iowa						36	804	3,354	4,389
Missouri						197	573	2,290	1,320
North Dakota									58
South Dakota								70	162
Nebraska						23	565	5,566	5,414
Kansas							295	94	134
WEST NORTH CENTRAL						256	3,278	13,126	14,944
Kentucky						36	27	187	62
Tennessee								13	0
Alabama						140	0	0	268
Mississippi	12	131	120	219	0	0	0	0	0
EAST SOUTH CENTRAL	12	131	120	219	0	176	27	200	330
Arkansas									6
Louisiana	62	572	291	199	268	287	360	496	1,029
Texas				44	39	147	458	795	1,335
WEST SOUTH CENTRAL	62	572	291	243	307	434	818	1,291	2,370
Idaho									380
Colorado						4	0	35	114
New Mexico		18	100	148	153	0	161	0	0
Arizona	52	205	222	712	1,018	2,259	2,124	4,046	3,797
Utah								3	[2]/
Nevada							8	51	8
MOUNTAIN	52	223	322	860	1,171	2,263	2,293	4,135	4,300
Washington	3	0	0	0	0	0	19	783	4,452
Oregon							23	53	891
California	2,764	4,781	3,514	6,173	8,663	9,187	10,445	20,590	37,142
PACIFIC	2,767	4,781	3,514	6,173	8,663	9,187	10,487	21,426	42,485
CONTINENTAL U. S.	2,893	5,783	4,247	7,497	10,509	14,276	21,320	46,983	76,144
Hawaii								3,023	8,480
Puerto Rico						3	0	1,398	355
TERRITORIES						3	0	4,421	8,835
TOTAL	2,893	5,783	4,247	7,497	10,509	14,279	21,320	51,404	84,979

[1]/ There was no reported consumption in States not shown.
[2]/ Less than 1 ton.

Agricultural need for nitrogen still exceeded the supply and in 1950 a nitrogen expansion program was initiated in an effort to satisfy this shortage and to supply future requirements. Additional construction will have increased the number of synthetic ammonia plants to 46 by the end of 1956. This will raise the estimated annual production capacity of the United States to 3,554,000 tons of ammonia (table 3). The locations of these new plants are scattered with at least 1 plant in every continental region except the Mountain Region. The plant locations are shown in figure 5 which also shows the location of those producers manufacturing nitrogen solutions, including aqua ammonia.

Additional plants, including one in the Mountain Region, are under way and upon completion the domestic synthetic ammonia production capacity will be about 3,917,000 tons.

Another potential source of direct-application ammonia is the 16,621 tons produced in 1955 by the by-product coke-oven plants in the form of aqua ammonia. This material would have a limited market because of its low analysis but it could be used to supplement the other direct-application materials.

GROWTH CHARTS ARE *NOT* JUST CORN

It is a matter of record that feeding nitrogen to plants increases crop yields. Also a matter of record is the quality, uniformity and dependability of STEAMBOAT BRAND with which your own business can chart increased profits.

You can be certain of the delivery you want, when you want and need it, *by rail or truck.* A Bradley & Baker representative will gladly help you plan your shipments. Technical assistance is available upon request for your manufacturing problems.

STEAMBOAT BRAND AMMONIUM NITRATE 33.5% N superior prills; all fines have been removed for uniformity and better mechanical condition; packed in attractive polyethylene-lined multiwall paper bags.

STEAMBOAT BRAND AMMONIUM NITRATE SOLUTIONS — to meet every specification of fertilizer manufacturers; *both ammonium nitrate and ammonium nitrate-urea types.*

STEAMBOAT BRAND ANHYDROUS AMMONIA — high quality maintained even at times of highest demand.

MISSISSIPPI RIVER CHEMICAL COMPANY
A Division of Mississippi River Fuel Corp. St. Louis, Mo.

Sales agents: BRADLEY & BAKER • 155 EAST 44th STREET • NEW YORK 17, N. Y.
District Sales Offices: ATLANTA • INDIANAPOLIS • ST. LOUIS • NORFOLK • HOUSTON

Sackett Builds The Equipment You Need

- **Continuous Granulating Units**
- **Plant Modernization Programs**
- **One Man Batch Weigh Systems**
- **Mixing and Shipping Equipment**

Aerating Equipment
Automatic Control Equipment
Basing Units
Belt Conveyors
Bucket Elevators
Centralized Control Systems
Continuous Acidulating Processes
Continuous Ammoniating Systems
Conveyors
Coolers
Crushers
Disintegrators
Dry-Mixing Units
Dust-Arresting Equipment
Fume Scrubbing Systems
Hoppers and Spouts
Materials Handling Equipment
Milling and Screening Units
Multiple Hopper Batching Systems
Oil Fired Dryers
Plant Mechanization Systems
Pneumatically-Operated Gravity Batch Mixers
Pneumatically-Controlled Valves
Pulverizers
Sackett Timken Bearings
Sacking Units
Scales
Screens
Shipping Units
Shuttle Belt Conveying Systems
Tailing Mills
Vacuum Condensing Systems

GET THE RIGHT ANSWER TO YOUR PRODUCTION PROBLEMS *get Sackett*

SACKETT

THE A. J. SACKETT & SONS CO.
1727 S. HIGHLAND AVENUE
BALTIMORE 24, MARYLAND

Table 3. Location and estimated annual capacity of anhydrous ammonia plants, by regions, January 1, 1957.

REGION	Plants	Estimated Annual Capacity
	(No.)	(1,000 Tons)
Middle Atlantic[1]/	9	584
East North Central	6	538
West North Central	5	354
East South Central[2]/	8	773
West South Central	10	941
Pacific	8	364
TOTAL	46	3,554

[1]/ Includes 1 plant in New England.
[2]/ Includes 2 plants in the South Atlantic Region.

Summary.

The fertilizer nitrogen used in the fiscal year ended June 30, 1955, in the United States and Territories, was almost triple the quantity used in the fiscal year 1946. Almost 60 percent was in the form of separate materials in 1955 compared to about 40 percent in 1946. Ammonium nitrate has consistently supplied more direct-application nitrogen since 1946 than any other individual material. Anhydrous ammonia became the second largest source in 1952, supplying 137,983 tons of nitrogen, and its use has continued to increase. Direct-application ammonia was being used by 1955 in every State in the United States except Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island. Nitrogen solutions, including aqua ammonia, also have risen to prominence in the last few years and were being applied directly to the soil in all but 11 States in 1955. The increased use of anhydrous ammonia and other liquid sources of nitrogen has been possible because of the expansion of the ammonia industry. Previous to World War II there were only 9 domestic synthetic ammonia plants with an estimated annual production capacity of 377,000 tons of nitrogen. This capacity will have been increased to 3,554,000 tons by the end of 1956. There will be 46 plants with at least 1 in each continental area except the Mountain Region.

INDUSTRY CALENDAR

Date	Organization	Place	City
Jan. 8-9	Texas Fert. Conf.	Texas A&M	College Sta., Tex.
Jan. 23-25	Sou. Weed Conf.	Bon Aire	Augusta, Ga.
Feb. 14-15	Middle West Soil	Edgewater Beach	Chicago, Ill.
June 9-12	NPFI	The Greenbrier	White Sulphur Springs, W. Va.
June 17-19	Sou. Control Officials	Dinkler-Tutwiler	Birmingham, Ala.
July 10-14	Plant Food Producers of Eastern Canada	Manoir Richelieu	Murray Bay
July 17-19	SW Fert. Conf.	Galvez Hotel	Galveston, Texas

Richardson Offers Bulletin On Fertilizer Scale

A new high-speed automatic fertilizer bagging scale, capable of bagging up to 24 sacks per minute, is described and illustrated in a new two-page, two-color product data sheet, No. 5601, now offered by Richardson Scale Co.

In describing Richardson's HA-39 fertilizer scale, the data sheet discusses such features of the scale as: design simplicity; full-automatic operation, with automatic belt feeder and discharge; totally enclosed dust-tight construction, stainless steel construction of contact parts; and maintenance. Key specifications are listed in a separate table.

The data sheet is illustrated with a photograph of the HA-39, as well as a dimensional drawing.

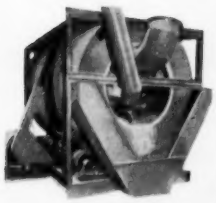
For copies of Richardson's Product Data Sheet No. 5601 on the HA-39 fertilizer scale, write to Richardson Scale Co., Van Houten Ave., Clifton, N. J.

Hyster Color Film Loaned Free

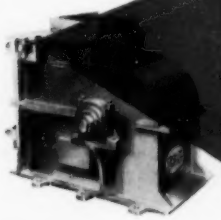
Hyster's new look in Lift Trucks, is the subject of a new ten-minute color and sound film. Comparative action views are utilized to illustrate "Panoramic Visibility." Important Job advantages and improved operator safety and comfort are pictured.

Reservations to view the 16 mm film without charge can be made through Hyster Industrial Truck Dealers or Hyster Company, 2902 N.E. Clackamas Street, Portland 8, Oregon.

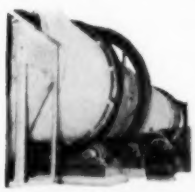
NEW STAR* OF THE SACKETT GRANULATING TEAM



SACKETT AMMONIATOR
A performance-proved machine combining the desirable T.V.A. submerged ammoniation design with Sackett time-honored rugged construction. Select the size you need from 15 to 60 tons per hour.



SACKETT BAR MILLS
This is the first mill, to our knowledge, that has been designed specially for use in *cracking* . . . not pulverizing . . . the granular oversize from the final product classifying screen. Its gentle impact action on the material accomplishes desired size reduction with minimum formation of fines.



SACKETT COOLERS
No other manufacturer offers such a complete selection of sizes and capacities. Rugged construction and highly efficient dust control are two of their noteworthy features. Infinite number of diameter and length combinations assure you of just the right one for your capacity and space requirements.

The Sackett STAR* Granulator is an entirely new and revolutionary approach to the granulation of fertilizer mixed goods.

Here's what the STAR will give you:

CONTROLLED GRAIN SIZE
New concept of grain size control. Larger percentage thru 6 on 16 mesh range, smaller portions of under and oversize.

HIGHER PRODUCT RECOVERY
Up to fifty percent increase in product recovery, because of its inherent, vigorous rolling—*not sliding*—action.

HIGHER PRODUCTION CAPACITY
More granulation the first time through, means substantially higher production capacity.

LOWER DRYING COST
Higher percentage of on-size in initial granulation means less fuel cost per ton due to lower hydration of total feed.

OTHER SACKETT PRODUCTS

Batch Weigh Systems

Mixing and Shipping Units

Materials Handling Equipment

Superphosphate Manufacturing Processes

*U. S. and Foreign Patents Pending

SACKETT STAR* GRANULATOR
This new machine has been called "The Missing Link" so badly needed in granulation. It performs the important job of forming a far greater portion of the initial feed into pellets of acceptable size. Select yours from a complete capacity range from 15 to 60 tons per hour.

Established Fertilizer producers are invited to get our up-to-the-minute counsel on their conversion and expansion programs. It is available without cost.

SACKET DRYERS
These highly efficient direct heat gas or oil-fired units are built to give many years of service in spite of the severe conditions under which they must operate. Unique tuyere design combustion chamber assures reduced chemical losses and maintenance costs. Built in sizes to meet every capacity requirement.

THE A. J. SACKETT AND SONS COMPANY
SACKETT EQUIPMENT
BALTIMORE • MARYLAND

Architects and Manufacturing Engineers to the Fertilizer Industry Since 1897.

America's Foremost Creative designers & Builders of Commercial Fertilizer and Superphosphate Plants . . . Related Production Equipment

"In nitrogen they're sure it"

Farmers are agreed on the maximum value they get out of the two superior sources of non-acid forming nitrogen, NITROLIME and CAL-NITRO. And dealers are agreed they get maximum sales and profits when they sell these perfectly balanced crop foods.

These vital fertilizer compounds, economical, uniform and dependable, are half nitrate nitrogen and half ammonia nitrogen to assure balanced plant feeding for greater crop yields. They are both fast-acting and resistant to leaching and come in handy granular form, free-flowing for easy hand or machine application.

It's easy for you to tell the CAL-NITRO and NITROLIME story—a proven merchandising program will help you sell these fine nitrogen products through sample displays, local newspaper and radio advertising and other sales aids. In addition, the extensive experience of Bradley & Baker is available through their representatives.

NON-ACID FORMING

BRADLEY & BAKER

155 EAST 44 STREET • NEW YORK 17, N. Y.

District Sales Offices: ATLANTA, GA. · INDIANAPOLIS, IND. · ST. LOUIS, MO. · NORFOLK, VA.

ECONOMIC COMPARISON OF FARM APPLICATION OF DRY AND LIQUID TYPES OF NITROGEN IN IOWA [1/] [2/] [3/]

by
EARL O. HEADY
Professor of Economics
Iowa State College
Ames, Iowa
and
E. L. BAUM
Chief, Agricultural Economics Branch
Division of Agricultural Relations
Tennessee Valley Authority
Knoxville, Tennessee

The use of nitrogen fertilizer solutions is a relatively recent practice in Iowa. Use and pricing patterns are in a state of flux. This study is based on data secured during June 1956. It is recognized that price relationships for nitrogen in different forms may change significantly in the near future and thereby some of the relationships presented in this article may be changed. The main purpose of this article is to demonstrate a methodological approach to studying comparable costs of applying dry and liquid types of nitrogen fertilizer.

Introduction

Farmers have three basic decisions to make in the profitable use of fertilizer: (a) the crops on which fertilizer should be used, (b) the amounts of fertilizer to use per acre on the crops being fertilized, and (c) the form and source of nutrients. The choices among alternatives in these three areas of decision-making involve both agronomic and economic information. Agronomic information is necessary as a basis for determining the physical input-output, or response quantities, associated with fertilizer applied in different amounts, in different forms, and by alternative methods on different crops. At each point of decision, however, the farmer must apply economic principles and information in the selection of a fertilization plan which is integrated into the profit maximization goal of the entire farm. With respect to decisions on the crops to be fertilized, the farmer must select those crops which will give the greatest return to his limited capital. Or, he must compare the return from fertilization of specific crops to the return from the same capital used for livestock enterprises, or other investment opportunities within the farm business.

Capital limitations also may affect the most profitable rate of fertilization, once the decision has been made to fertilize a particular crop. The farmer may find, for example, that the first 20 pounds of nitrogen per acre applied on grain will return $2.00 per $1.00 invested; a second 20 pounds per acre may return only $1.50. Hence, if capital invested in livestock or feed wil return $1.75 per $1.00 invested, the most profitable rate of fertilization will be only 20 pounds per acre for the farmer with limited funds. Of course, if the farm operator is not confronted with capital restrictions, he should increase the level of fertilization until the added return per increment of applied nutrients begins to approach the cost per unit of applied nutrients.

Similarly, the manner of applying nutrients and selection of their source also may depend upon the capital structure of the farm. A farmer may have sufficient acres so that ownership of storage tanks and applicators and use of liquid fertilizer represent, under his particular situation, the least-cost method of application provided he can use the equipment throughout its normal life and figure depreciation costs accordingly. For a particular acreage, the out-of-pocket costs per acre per year may be less for liquid-form than dry-form fertilizer over the life of the equipment. Yet the farmer with limited funds still must consider the opportunity cost principle. Will the capital invested in storage tanks and application equipment return more profit if invested in livestock or other opportunities in the farm business? If this happens to be the case, the decision should be to use dry-type fertilizer, even though the cash or direct costs per acre are greater for the dry-type than for liquid fertilizers. The farmer then should plan to invest the difference in cost of equipment elsewhere in the farm business. Or, conversely, if heavy rates of liquid fertilizer application can be obtained at low cost on a custom basis, it is possible that the farmer with limited labor and capital can best use this method and thereby release capital for livestock or other investment.

If, however, the farmer has no capital restrictions, the most profitable source of nutrients and method of application will be the one with the lowest cash costs or direct costs per acre.[4] A farmer in this situation does not need to consider alternative investment opportunities because his capital position will allow independent decisions on the amount to be invested in each segment of the business.[5]

Obviously, then, universal recommendations cannot be made on which crops to fertilize, the rate of fertilization, or the source of nutrients and the method of application. The choice, if it is to be one consistent with profit maximization,

1. The authors are indebted to Wes Smith and Loren Ihnen for assisting in collection of data and in making calculations.

2. Liquid nitrogen fertilizers include all nitrogen materials in nonpressure (aqua ammonia), low-pressure (nitrogen and urea solutions), and high-pressure (anhydrous ammonia) solution forms.

3. A preliminary version of this manuscript was presented at Seminars for Cooperators in the TVA Agricultural Economics Research Activities at Knoxville, Tennessee, March 27-30, 1956. A follow-up survey during June 1956 was conducted to make the cost and price data more recent and complete.

[4] The term cash or direct cost is used to denote that opportunity costs are not included in the calculation of reference.

[5] This would apply only to investments made in farming. Actually, a farmer with large quantities of capital would consider returns from capital invested in farming relative to other investment opportunities. However, from the standpoint of the farm business the above statement is true.

must be one which fits the resource situation of the individual farm.

Liquid- and Dry-Type Fertilizers

The following discussion deals with the relative costs of liquid- and dry-type fertilizers for Iowa farms. As pointed out above, the economy of the two methods of farm application will depend on the circumstances of the individual farm. However, it is possible to compare the cost relationships of liquid- and dry-type fertilizers as a guide to farmers both with and without capital restrictions. Farmers without capital restrictions need only this information on comparative unit costs for their acreage. Farmers with capital restrictions also need this information as a first step in determining the most profitable (a) method of application, and (b) source of applied plant nutrients. If, for his acreage, the farmer finds the per unit cost of fertilization to be lower for the dry-form nitrogen, he will generally select this method: Not only will the cost per unit of nitrogen applied (i.e., per acre fertilized) be lower, but also this method will require the smallest capital investment. If, for his acreage, he finds nitrogen fertilizer solutions to have the lowest unit cost, he will need to take one more step in deciding which type of nitrogen fertilizer to apply. He must determine whether the savings in cost per acre for the liquid nitrogen are more or less than the added return from difference in capital required (i.e., for the liquid- and dry-form application equipment), if it were invested elsewhere in the business.

Use of nitrogen fertilizer solutions is a relatively recent practice in Iowa. The high-pressure form (anhydrous ammonia) has had greatest use to date. Use and pricing patterns are in a state of flux. Farmers are only now becoming well acquainted with these new materials. Most farmers still own equipment for the dry-type fertilizer and find that it has low salvage value on the market, in comparison with the cost of new liquid storage tanks and application equipment. However, with the relatively lower price per unit of nitrogen fertilizers in liquid form, an increasing number of farmers are becoming, and will continue to become, interested in using these new forms of nitrogen. It appears that liquid nitrogen has a particular cost advantage for high rates of fertilization. This relationship exists because the lower cost per unit of liquid nitrogen more than offsets the higher per acre cost of equipment for high rates of fertilization. Also, custom hiring of liquid application is more economical, in comparison with the dry form of nitrogen, when application rates are heavy. In view of the favorable situations as old equipment is used up and farmer experience increases, and as pricing procedures for nitrogen fertilizer solutions become more definite, the use of these materials is expected to increase relative to the total amount of nitrogen. As is mentioned later, farmers are faced with both conveniences and difficulties in application of liquid nitrogen fertilizers. Within the next few years, it is expected that certain difficulties with equipment will be overcome and added impetus will be given to the use of liquid fertilizer materials.

Method of Comparison

Information on the least-cost method of application can be used for either class of farmers mentioned above as a basis for choosing the type of material and method of application. Profit maximization principles require that the cost comparison be measured in terms of product output. The least-cost resource (i.e., source of nutrient and method of application), or resource combination is determined by relating the prices (costs) per unit of the alternative resources with their substitution or replacement rates, in reference to a specified level of production or yield. Determination of these least-cost combinations for each level of yield by this procedure makes possible construction of a per unit cost schedule for the alternative methods or resources. The procedure followed in this study is to compute directly the per acre costs of applying certain liquid and solid fertilizers.

Cost Comparisons

(The data cited represent the nutrient prices and machine costs found in a survey of farmers and dealers in northern Iowa during June, 1956.)[6]

The greatest proportion of liquid fertilizers is applied on a custom basis. Most of the farmers applying anhydrous ammonia are largescale operators owning equipment singly; or represent several farmers owning equipment jointly, with a relatively large acreage to fertilize. Practically all solution fertilizer is applied on a custom basis. Therefore, the appropriate comparison of costs of application may be that of custom application of liquid fertilizers with that of farmer application of dry-type fertilizer. However, in the analysis which follows, cost data will be presented for both custom application and farmer ownership of equipment for liquid fertilizers. **Prices for nutrients will be the modal or typical prices in northern Iowa during June, 1956. However, it should be recognized that prices to farmers, particularly for solution fertilizers, may be subject to many changes in the next few years.**

Comparisons are made both between non- and low-pressure liquid- and dry-type nitrogen and between the high-pressure liquid- and dry-

[6]*Conducted under a cooperative research project between Iowa State College and TVA.*

TABLE 1. Fixed Costs for Different Methods of Nitrogen Application and Different Sizes of Equipment. Costs Figured on a Basis of 1956 Prices[1]

	SIZE OF EQUIPMENT	Total Fixed Costs per Year
	Dry-Type Nitrogen	
(1)	8-foot distributor	$ 28.15
(2)	10-foot distributor	31.66
(3)	12-foot distributor	37.31
	Non- and Low-Pressure Liquid Nitrogen	
(4)	5-row applicator without storage tank	130.63
(5)	5-row applicator with 550 gal. movable tank	220.17
(6)	5-row applicator with 1000 gal. movable tank	268.33
(7)	3-row applicator without storage tank	94.48
(8)	3-row applicator with 550 gal. movable tank	184.02
(9)	3-row applicator with 1000 gal. movable tank	232.18
	High-Pressure Liquid Nitrogen	
(10)	5-row applicator without storage tank	98.37
(11)	5-row applicator with 550 gal. movable tank	186.09
(12)	5-row applicator with 1000 gal. movable tank	232.29
(13)	3-row applicator without storage tank	91.96
(14)	3-row applicator with 550 gal. movable tank	179.68
(15)	3-row applicator with 1000 gal. movable tank	226.88

[1]Fixed costs are based on the average retail price for the several types and makes of machines which can be purchased in north central Iowa. All costs assume a 150-gallon tank on application and gravity flow control valve.

POTASH RAISES FARM INCOME. The successful American orange grower. He's not shy about his success. He'll tell you the importance of frost prevention and the newest insect sprays. He'll probably talk well-balanced fertilizers and potash content, too. And he's the one to talk—grows the biggest, juiciest oranges around! His land isn't better than anyone else's. He treats it better, that's all.

USP's high-grade muriate of potash is free-flowing and non-caking and has the highest K_2O content—62/63% K_2O. Also available, USP's granular muriate of potash contains a minimum of 60% K_2O.

UNITED STATES POTASH COMPANY

DIVISION OF UNITED STATES BORAX & CHEMICAL CORPORATION

30 Rockefeller Plaza, New York 20, New York. Southern Sales Office: Rhodes-Haverty Building, Atlanta, Georgia.

REG. U. S. PAT. OFF.

type nitrogen.[7] In using any of these sources of nitrogen fertilizer, numerous combinations of application equipment and storage facilities can be used. However, for a vivid graphical comparison of alternatives, only a reasonable number of sizes and combinations of machines and storage tanks are presented in the text. Liquid applicating equipment typically includes 5-row, trailer-type machines with a 100-150 gallon tank, and flow control valves.

Common sizes of storage tanks are 550 and 1000 gallons. However, quite frequently, dealers loan or rent storage tanks to farmers. In the graphical comparisons which follow, the quipment for liquid fertilizers is 5-row equipment: (a) without investment in storage tank, (b) with a 550-gallon tank, and (c) with a 1000-gallon tank. Data are presented in tables 3, 4, and 5 for other sizes of machines and metering pumps. The makes and kinds of machines which are most widely and commonly used are included for the data of the text and for tables 3, 4, and 5. Since some less costly equipment is on the market, its fixed costs per acre fertilized are presented in figures 7 and 8. Variable and nutrient costs per acre for these less commonly used machines are the same as for the ones serving as a basis for discussion in the text.

[7] *The application equipment for the non-pressure (aqua ammonia) and low-pressure (nitrate and urea solutions) nitrogen fertilizer solutions are grouped together in establishing machinery cost comparisons.*

TABLE 2. Total Investment in Equipment and Storage Tanks for Selected Dry- and Liquid-Form Distribution Systems Iowa, 1956

EQUIPMENT AND STORAGE COMBINATION	TOTAL Investment
Dry-Type Nitrogen	
8-foot distributor	$ 248
10-foot distributor	279
12-foot distributor	339
Non- and Low-Pressure Nitrogen Solutions[1]	
5-row applicator without tank	843
5-row applicator with 550 gal. movable tank	1,568
5-row applicator with 1000 gal. movable tank	1,958
High-Pressure Nitrogen Solutions[1]	
5-row applicator without tank	813
5-row applicator with 550 gal. movable tank	1,538
5-row applicator with 1000 gal. movable tank	1,928

[1] With gravity flow control valve. Applicator equipped with metering pump would require about $200 greater investment.

Per Acre Costs

Per unit costs of applied plant nutrient have been computed on the basis of an acre fertilized with liquid- or dry-type fertilizer. This method of analysis leads to correct decisions if the yield response is the same for the two methods, and the same amount of available nitrogen is applied in liquid or dry form. Of course, if the marginal (incremental)

TABLE 3. Total Fixed Cost per Acre for Alternative Methods of Fertilizer Application, Iowa. 1956.

Machine Combination (Applicator and Movable Storage Tank)	Fixed Cost per Acre for the Following Number of Acres Fertilized				
	120	240	360	480	600
	High-Pressure Nitrogen Fertilizer ($)				
5-row (trailer), 150 gal. tank; metering pump, without tank	1.04	0.52	0.35	0.26	0.21
5-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	1.76	0.88	0.59	0.44	0.35
5-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	2.16	1.08	0.72	0.54	0.43
5-row (trailer), 150 gal. tank; gravity flow, without tank	0.82	0.41	0.27	0.20	0.16
5-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	1.55	0.77	0.52	0.39	0.31
5-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	1.94	0.97	0.65	0.49	0.39
3-row (mounted), 100 gal. tank; metering pump, without tank	0.62	0.31	0.21	0.16	0.12
3-row (mounted), 100 gal. tank; metering pump, with 550 gal. tank	1.35	0.67	0.45	0.34	0.27
3-row (mounted), 100 gal. tank; metering pump, with 1000 gal. tank	1.75	0.87	0.58	0.44	0.35
3-row (mounted), 100 gal. tank; gravity flow, without tank	0.39	0.20	0.13	0.10	0.08
3-row (mounted), 100 gal. tank; gravity flow, with 550 gal. tank	1.12	0.56	0.37	0.28	0.22
3-row (mounted), 100 gal. tank; gravity flow, with 1000 gal. tank	1.52	0.76	0.51	0.38	0.30
3-row (trailer), 150 gal. tank; metering pump, without tank	0.98	0.49	0.33	0.25	0.20
3-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	1.71	0.85	0.57	0.43	0.34
3-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	2.11	1.05	0.70	0.53	0.42
3-row (trailer), 150 gal. tank; gravity flow, without tank	0.77	0.38	0.26	0.19	0.15
3-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	1.50	0.75	0.50	0.37	0.30
3-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	1.89	0.94	0.63	0.47	0.38
	Non- and Low-Pressure Nitrogen Fertilizer ($)				
5-row (trailer), 150 gal. tank; metering pump, without tank	1.09	0.54	0.36	0.27	0.22
5-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	1.83	0.92	0.61	0.46	0.37
5-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	2.24	1.12	0.74	0.56	0.45
5-row (trailer), 150 gal. tank; gravity flow, without tank	0.87	0.43	0.29	0.22	0.17
5-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	1.61	0.81	0.54	0.40	0.32
5-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	2.04	1.01	0.67	0.50	0.40
3-row (trailer), 150 gal. tank; metering pump, without tank	1.01	0.50	0.34	0.25	0.20
3-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	1.75	0.88	0.58	0.44	0.35
3-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	2.16	1.08	0.72	0.54	0.43
3-row (trailer), 150 gal. tank; gravity flow, without tank	0.79	0.39	0.26	0.20	0.16
3-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	1.53	0.77	0.51	0.38	0.31
3-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	1.93	0.97	0.64	0.48	0.39

yields were different per pound of applied liquid- and dry-type nitrogen, it would be necessary to make qualifications in the interpretation of the cost data. While some few studies have shown differential responses per unit of applied nitrogen in liquid- or dry-type forms, research on corn in Iowa does not show this to be true. Dumenil concluded that, pound for pound, there is little or no difference between kinds of nitrogen fertilizers (1). Cost per pound of the applied plant nutrient and its method of application thus become the important criteria. Therefore, if the farmer wishes to apply 40 pounds of nitrogen per acre, under these technological conditions, he need only compare the costs per acre for nitrogen fertilizer in liquid or dry form. The comparison can best be made in costs per acre for specific levels of fertilization, rather than in costs per unit of applied nitrogen, since there are certain fixed costs per acre which do not change as the rate of fertilization is increased.

Location and Crop

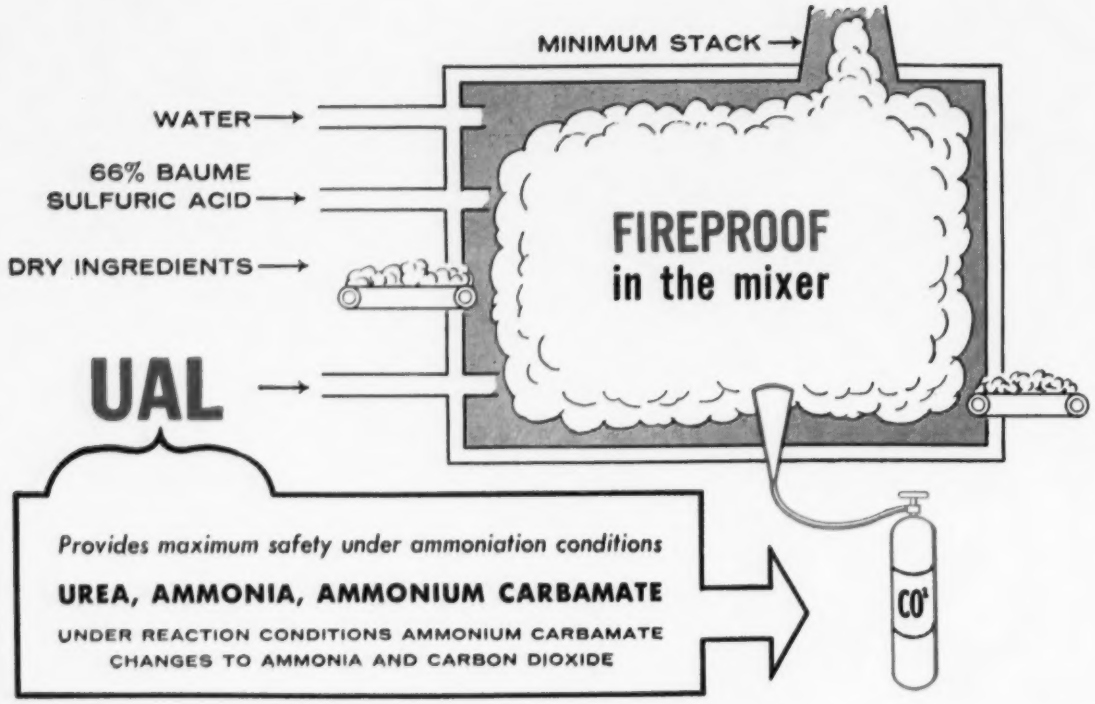
The empirical analysis which follows relates to use of nitrogen on corn in northern Iowa. Corn has been selected for the study because it is of major economic importance in the state. Nitrogen has been selected as the applied nutrient because the potential of applying it in liquid forms appears to be greater than for other fertilizer mixtures. The use of liquid mixed fertilizers is now only in the innovation stage. While this study refers specifically to northern Iowa, its cost comparisons ought to have general application over the state, because the analysis is made in terms of per acre costs of applying nitrogen in the different forms. While the response to given amounts of applied nitrogen may differ by soil types (and by farms or fields within a soil type, depending on previous management), the costs of application should be similar at different locations, given the prices of fertilizer and application equipment. Given the per acre costs of applying liquid- and dry-type fertilizers, account can then be taken of differential responses and the decision can be made accordingly in determining (a) the amount of fertilizer to apply on a given soil type (on a field or farm), and (b) the method of application. Surveys fail to show any major differences in farmers' opinions on use of equipment by soil topography. However, as indicated later, an occasional farmer has expressed the opinion that correct placement of liquid fertilizers is somewhat more difficult on very steep slopes.

Decision-Making Costs

Fertilization, by any method or source of materials, involves two major categories of costs: (a) **Variable Costs** which depend on the number of acres fertilized and the rate of fertilization per acre. The main variable costs for liquid or dry form of fertilizers are represented by the costs of the nutrients. However, other items are included also in variable costs. These include the cost of labor used in filling containers or applicating equipment, and in applying the fertilizer; the cost of the tractor power used in pulling application equipment and the cost (due to actual usage) of the appli-

TABLE 4. Total Cost per Acre of Applying Fertilizer (Fixed Plus Variable With Cost of Nutrients Excluded) for Alternative Methods of Fertilizer Application (Labor Included in Costs), Iowa, 1956.

Machine Combination (Applicator and Movable Storage Tank)	Total Applying Cost per Acre for the Following Number of Acres Fertilized				
	120	240	360	480	600
	High-Pressure Nitrogen Fertilizer ($)				
5-row (trailer), 150 gal. tank; metering pump, without tank	1.62	1.10	0.93	0.84	0.79
5-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	2.34	1.46	1.17	1.02	0.93
5-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	2.74	1.66	1.30	1.12	1.01
5-row (trailer), 150 gal. tank; gravity flow, without tank	1.40	0.99	0.85	0.78	0.74
5-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	2.13	1.35	1.10	0.97	0.89
5-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	2.52	1.55	1.23	1.07	0.97
3-row (mounted), 100 gal. tank; metering pump, without tank	1.20	0.89	0.79	0.74	0.70
3-row (mounted), 100 gal. tank; metering pump, with 550 gal. tank	1.83	1.25	1.03	0.92	0.85
3-row (mounted), 100 gal. tank; metering pump, with 1000 gal. tank	2.33	1.45	1.16	1.02	0.93
3-row (mounted), 100 gal. tank; gravity flow, without tank	0.97	0.78	0.71	0.68	0.66
3-row (mounted), 100 gal. tank; gravity flow, with 550 gal. tank	1.70	1.14	0.95	0.86	0.80
3-row (mounted), 100 gal. tank; gravity flow, with 1000 gal. tank	2.10	1.34	1.09	0.96	0.88
3-row (trailer), 150 gal. tank; metering pump, without tank	1.56	1.07	0.91	0.83	0.78
3-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	2.29	1.43	1.15	1.01	0.92
3-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	2.69	1.63	1.26	1.11	1.00
3-row (trailer), 150 gal. tank; gravity flow, without tank	1.35	0.96	0.84	0.77	0.73
3-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	2.08	1.23	1.08	0.95	0.88
3-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	2.47	1.52	1.21	1.05	0.96
	Non- and Low-Pressure Nitrogen Fertilizer ($)				
5-row (trailer), 150 gal. tank; metering pump, without tank	1.67	1.12	0.94	0.85	0.80
5-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	2.41	1.50	1.19	1.04	0.95
5-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	2.82	1.70	1.32	1.14	1.03
5-row (trailer), 150 gal. tank; gravity flow, without tank	1.45	1.01	0.87	0.80	0.75
5-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	2.19	1.39	1.12	0.98	0.90
5-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	2.59	1.59	1.25	1.08	0.98
3-row (trailer), 150 gal. tank; metering pump, without tank	1.59	1.08	0.92	0.83	0.78
3-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	2.33	1.46	1.16	1.02	0.93
5-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	2.74	1.66	1.30	1.12	1.01
3-row (trailer), 150 gal. tank; gravity flow, without tank	1.37	0.97	0.84	0.78	0.74
3-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	2.11	1.35	1.09	0.96	0.89
3-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	2.51	1.55	1.22	1.06	0.97



Granulating is fireproof with Du Pont URAMON® Ammonia Liquors

Du Pont "Uramon" Ammonia Liquors give you maximum safety in high-temperature granulating by eliminating dangerous flash fires in the mixer; and, further, by assuring safety in the pile.

Fireproof conditions are maintained in the mixer when Du Pont UAL is used. As the ammoniation proceeds, the ammonium carbamate in UAL changes to ammonia and carbon dioxide. Ammonia enters the reaction and carbon dioxide displaces the air, thus creating conditions that guard against combustion.

Four formulations are available . . . all are equally safe for granulating. For technical assistance and information on the solution best suited to your use, write Du Pont.

HERE ARE OTHER IMPORTANT ADVANTAGES OF DU PONT URAMON® AMMONIA LIQUORS:

- High-quality nitrogen from UAL resists leaching . . . supplies both urea and ammonium forms of nitrogen.
- Won't corrode regular fertilizer manufacturing equipment, including ordinary steel and aluminum.
- Gives mixed goods better "feel"—minimizes caking, segregation and dusting.
- Suitable for either batch or continuous mixing.
- Prompt, dependable delivery enables you to schedule your production with confidence.

DU PONT REG. U. S. PAT. OFF **URAMON®** AMMONIA LIQUORS

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

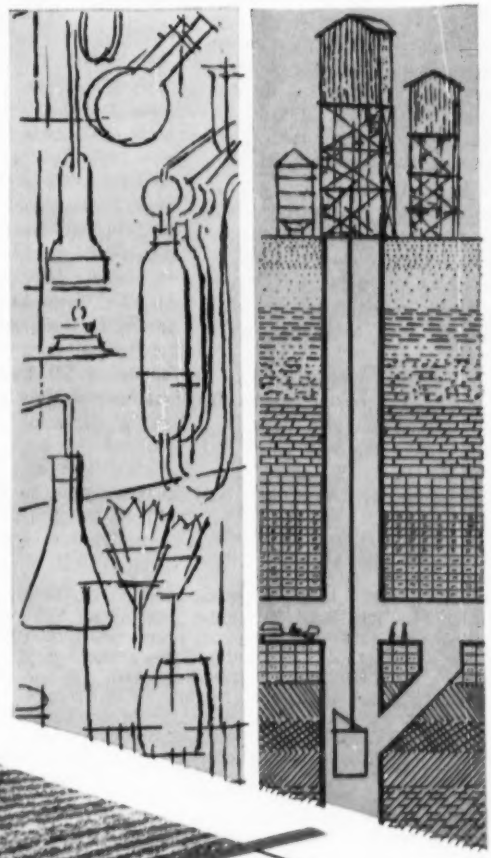
E. I. DU PONT DE NEMOURS & CO. (INC.)
Polychemicals Department • Wilmington 98, Delaware
1616 Walnut Street, Philadelphia 3, Pa. — 7250 N. Cicero Ave., Chicago 30, Ill.
Du Pont Company of Canada (1956) Limited
85 Eglinton Avenue East, Toronto, Canada

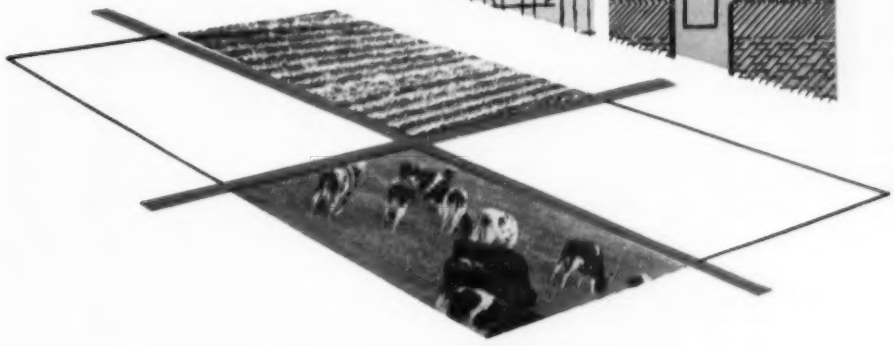
LOOK TO NATIONAL POTASH FOR QUALITY AND SERVICE

Backed by the skills and experience of its parent companies – Pittsburgh Consolidation Coal Company and Freeport Sulphur Company – NATIONAL POTASH offers important advantages as a dependable source of quality potash.

NATIONAL'S mining operations and refining processes will include the very latest industry techniques, and its storage and shipping facilities have been planned to meet efficiently the demand of the peak fertilizer season.

In addition, NATIONAL POTASH provides a free, comprehensive Technical Service to help manufacturers with granulation, formulation and other production problems. Write for complete information.





NATIONAL POTASH COMPANY
205 EAST 42nd ST. • NEW YORK 17, N. Y.

cating equipment itself. (b) **Fixed Costs** which do not vary with the number of acres fertilized or the rate of fertilization. Fixed costs are mainly those associated with application machinery and storage facilities. A certain amount of depreciation occurs for these items, regardless of the number of acres fertilized or the amount of fertilizer used. Weather depreciation (corrosion and general deterioration) as a function of time falls in this category. Obsolescence, insurance, and taxes which are paid on the equipment are also fixed costs.

On farms where the family labor supply is sufficiently large, use of labor does not involve an out-of-pocket cost. While the amount of labor used in crop production may vary with the amount of fertilizer used and the method of application, variations in labor inputs do not alter the total costs of the farm. The surplus family labor simply goes unused at no particular cost. In these cases, labor costs do not need to be included as either variable or fixed costs when decisions are made on the form of nitrogen fertilizer or the method of application to be used. If the farmer hires help he may well consider labor costs in determining whether liquid- or dry-type nitrogen fertilizer materials should be used.* Of course, nonprofit considerations, such as the ease of handling and the smaller physical exertion, may be an important consideration, as it often is for liquid fertilizer.

Liquid forms of fertilizer, where the farmer owns the equipment ordinarily have greater fixed costs associated with them than the dry forms of nitrogen fertilizer. The special application equipment and storage tanks for liquid nitrogen fertilizers have a much greater initial cost than most dry-form equipment. The data in table 1 indicate that fixed costs per year for liquid nitrogen application equipment and storage tanks exceed those of dry-form fertilizer from 3 to 10 times, depending on the sizes and combinations of equipment. Obviously, then, the least-cost method of application rests largely on the number of acres to be fertilized and the rate of application to be used.

If "fixed" family labor is available, or hired help has been hired on a yearly basis, the method of fertilization selected may depend on the productivity of labor used on other farm activities. If labor gives, for example, a high return when used in feeding cattle or raising spring pigs, liquid fertilization may be selected to minimize labor inputs for this activity, in order that a large livestock enterprise can be handled with given labor.

Relative Levels of Variable Costs and Custom Application

The price or cost per pound of nitrogen fertilizer (the main variable cost) is lower for the liquid- than for dry-type form. The farmer who has sufficient acres over which to spread the greater fixed costs of equipment for liquid fertilizers may gain materially from the lower cost per pound of nitrogen. When custom application is used, all costs of fer-

TABLE 5. Total Cost per Acre of Applying 50 Pounds of Nitrogen per Acre for Alternative Methods of Fertilization Application (Labor Included as a Cost), Iowa, 1956.

Machine Combination (Applicator and Movable Storage Tank)	Total Cost per Acre for the Following Number of Acres Fertilized				
	120	240	360	480	600
	High-Pressure Nitrogen Fertilizer ($)				
5-row (trailer), 150 gal. tank; metering pump, without tank	5.56	5.04	4.87	4.78	4.73
5-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	6.09	5.21	4.92	4.77	4.68
5-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	6.49	5.41	5.05	4.87	4.76
5-row (trailer), 150 gal. tank; gravity flow, without tank	5.34	4.93	4.79	4.72	4.68
5-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	5.88	5.10	4.85	4.72	4.64
5-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	6.27	5.30	4.98	4.82	4.72
3-row (mounted), 100 gal. tank; metering pump, without tank	5.14	4.83	4.73	4.68	4.64
3-row (mounted), 100 gal. tank; metering pump, with 550 gal. tank	5.58	5.00	4.78	4.67	4.60
3-row (mounted), 100 gal. tank; metering pump, with 1000 gal. tank	6.08	5.20	4.91	4.77	4.68
3-row (mounted), 100 gal. tank; gravity flow, without tank	4.91	4.72	4.65	4.62	4.60
3-row (mounted), 100 gal. tank; gravity flow, with 550 gal. tank	5.45	4.89	4.70	4.61	4.55
3-row (mounted), 100 gal. tank; gravity flow, with 1000 gal. tank	5.85	5.09	4.84	4.71	4.63
3-row (trailer), 150 gal. tank; metering pump, without tank	5.50	5.01	4.85	4.77	4.72
3-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	6.04	5.18	4.90	4.76	4.67
3-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	6.44	5.38	5.01	4.86	4.75
3-row (trailer), 150 gal. tank; gravity flow, without tank	5.29	4.90	4.78	4.71	4.67
3-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	5.83	4.98	4.83	4.70	4.63
3-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	6.22	5.27	4.96	4.80	4.71
Average Custom Rate	6.00	6.00	6.00	6.00	6.00
	Non- and Low-Pressure Nitrogen Fertilizer ($)				
5-row (trailer), 150 gal. tank; metering pump, without tank	7.51	6.96	6.78	6.69	6.64
5-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	8.06	7.15	6.84	6.69	6.60
5-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	8.47	7.35	6.97	6.79	6.68
5-row (trailer), 150 gal. tank; gravity flow, without tank	7.29	6.85	6.71	6.64	6.59
5-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	7.84	7.04	6.77	6.63	6.55
5-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	8.24	7.24	6.90	6.73	6.63
3-row (trailer), 150 gal. tank; metering pump, without tank	7.43	6.92	6.76	6.67	6.62
3-row (trailer), 150 gal. tank; metering pump, with 550 gal. tank	7.98	7.11	6.81	6.67	6.58
3-row (trailer), 150 gal. tank; metering pump, with 1000 gal. tank	8.39	7.31	6.95	6.77	6.66
3-row (trailer), 150 gal. tank; gravity flow, without tank	7.21	6.81	6.68	6.62	6.58
3-row (trailer), 150 gal. tank; gravity flow, with 550 gal. tank	7.76	7.00	6.74	6.61	6.54
3-row (trailer), 150 gal. tank; gravity flow, with 1000 gal. tank	8.16	7.20	6.87	6.71	6.62
Average Custom Rate	6.90	6.90	6.90	6.90	6.90

tilization are variable, i.e., the total amount spent for fertilization will depend on the number of acres fertilized and the per acre rate of fertilization. No overhead investment in application equipment and storage tanks is required. Farmers operating on a small scale have the same cost advantage as farmers operating on a large scale when fertilization is hired by both on a custom basis. The firm providing custom services usually fertilized enough acres so that the scale economies realized by it are as great as or greater than for the farmer fertilizing a large acreage. Of course, the custom firm charges for labor, as well as materials and machine use; whereas, the farmer with a small-scale operation applying dry-type nitrogen fertilizer, might not need to make an out-of-pocket charge for the use of his own labor. Thus, the farmer short on capital and who hires custom services for liquid nitrogen fertilizer may have these advantages: (a) He is in a flexible position since all costs (which are only variable costs) can be readily expanded or decreased as the price situation suggests. In this case, fixed costs will not continue if fertilization is curtailed. (b) Funds are saved for investment elsewhere in the farm business. However, these advantages are not unique to liquid fertilizers where custom services also are available for the dry-type fertilizers.

Time of Decision on Method

Both fixed and variable costs should be considered in comparing fertilization methods before investment is made in equipment. As a basis for short-run decisions, however, only variable costs can be considered. Once investment has been made in equipment, and if the original investment cannot be readily regained through sale of equipment in the market, the decision-making costs then become the variable costs of using the particular method at hand. A fertilizer technique represents, after purchase of equipment, the least-cost method if its variable costs per unit (plus any portion of fixed costs per unit which can be regained through resale of equipment) is less than the fixed plus variable cost per unit involved in buying the equipment for an alternative method of fertilization. Or, the decision in use of method can be explained by use of equation 1:

$$(1) \quad T = F + (f + l + m) A$$

The total cost, T, of fertilization is the sum of: (a) fixed costs, F, of machinery and equipment for fertilization; plus (b) the sum of variable cost of fertilizer materials, f; labor, l; and machine and power costs of a variable nature, m; multiplied by the number of acres, A, fertilized. Once the investment has been made in equipment, the F quantity of the equation can be ignored for the particular method of fertilization, particularly if the machine has low salvage or second-hand value. But when other methods are compared to the one in question, the F quantity must be included. Since many farmers have already invested in a method of fertilization, they may not shift to a new method immediately, because they do not need to consider the fixed costs of the present method. However, once present equipment wears out, and a new method of fertilizer application is considered, the fixed costs of both methods may be compared. The procedure used here is to consider only the "long-run" cost structure for each method, wherein, comparisons include fixed, as well as variable, costs.

Unit Cost Analysis

Because of the greater investment in equipment required, total fixed costs are greater for liquid fertilizers than for dry fertilizers when the farmer owns the equipment. This is true for commonly available sizes of machines, even where a storage tank is not purchased for liquid forms. The relationships presented in figures 1 and 2 indicate fixed cost per unit is greater for all liquid forms of application than for the most common sizes of equipment used to apply dry forms of nitrogen.* Hence, liquid nitrogen, when applied with the farmer's equipment, must have lower variable costs per acre if it is to have a cost advantage for any magnitude of operation.

Variable Cost Rates

At current market prices, nitrogen fertilizers prepared in liquid form sell at a lower price per pound than dry-form nitrogen fertilizers.

**A curve for a 10-foot dry-fertilizer distributor has not been included in figures 1 and 2, since it obviously falls between the curves for the 8- and 12-foot distributors.*

Figure 1.—Fixed costs per acre for selected sizes and combinations of equipment in applying high-pressure nitrogen fertilizer.

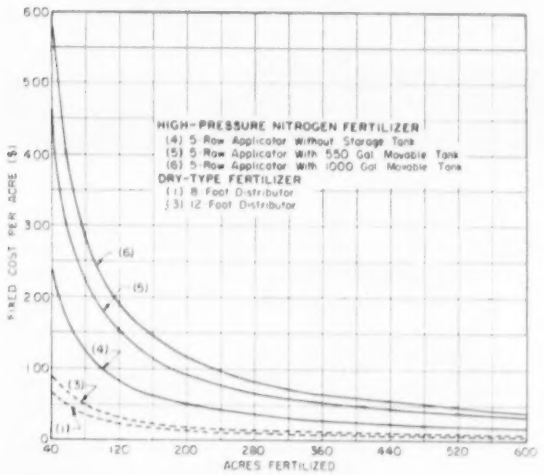
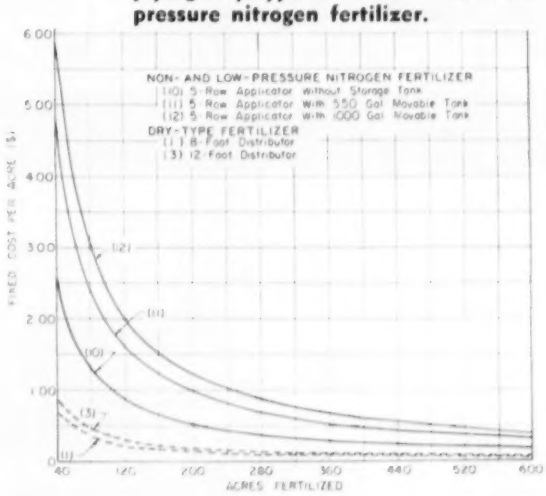

HIGH-PRESSURE NITROGEN FERTILIZER
(4) 5-Row Applicator Without Storage Tank
(5) 5-Row Applicator With 550 Gal. Movable Tank
(6) 5-Row Applicator With 1000 Gal. Movable Tank
DRY-TYPE FERTILIZER
(1) 8-Foot Distributor
(3) 12-Foot Distributor
FIXED COST PER ACRE ($)
ACRES FERTILIZED

Figure 2.—Fixed costs per acre for selected sizes and combinations of equipment in applying dry-type and non- and low-pressure nitrogen fertilizer.


NON- AND LOW-PRESSURE NITROGEN FERTILIZER
(10) 5-Row Applicator Without Storage Tank
(11) 5-Row Applicator With 550 Gal. Movable Tank
(12) 5-Row Applicator With 1000 Gal. Movable Tank
DRY-TYPE FERTILIZER
(1) 8-Foot Distributor
(3) 12-Foot Distributor
FIXED COST PER ACRE ($)
ACRES FERTILIZED

Typical or modal northern Iowa prices in 1956 were 13.3 cents per pound of nitrogen for dry fertilizer, 7.5 cents per pound of nitrogen in the form of anhydrous ammonia, and 11.3 cents per pound of nitrogen in the form of aqua ammonia, and nitrate and urea solutions. Prices to farmers ranged from 7.5 to 10 cents per pound of nitrogen in the high-pressure form and from 9.5 to 15 cents per pound of nitrogen in the non- and low-pressure form. Prices to farmers included discounts from $2 to $6 per ton for doing their own hauling and up to 5 percent for cash payment. However, since fixed costs are considerably greater for liquid fertilizers, total costs per acre where the farmer owns the equipment will be greater than for dry-form fertilizer on small acreages. The total cost for liquid nitrogen fertilizers falls below that for dry-type nitrogen fertilizer when the rate of fertilization becomes heavy enough, and when enough acres are fertilized to cause the difference in variable costs per acre to exceed the difference in fixed cost per acre.

The main variable cost for which there is difference between liquid- and dry-type nitrogen fertilizers is the material itself. Also included in variable costs are: labor, charged at $1.30 per hour; tractor power charged at $1.00 per hour for a 2-plow tractor and $1.40 per hour for a 3-plow tractor, and certain incidental repair items for equipment. Costs are computed using a 2-plow tractor for solid and a 3-plow tractor for the common sizes of liquid application equipment. In addition to these costs, some added labor is required for dry-type fertilizers, and for liquid fertilizers where a storage tank is not included equipment. To compensate for the added labor required under these methods, 15 cents has been added per acre when the rate of application is 50 pounds of nitrogen per acre; 30 cents per acre when the rate is 100 pounds per acre. The nutrient prices used in cost calculations are the modal prices of 7.5 cents and 11.3 cents, respectively, for high-pressure and non- and low-pressure liquid nitrogen fertilizers, rather than the average survey prices reported elsewhere in this paper.

Application of 50 Pounds of Nitrogen per Acre

If the farmer owns a 5-row applicator without a storage tank, the costs of applying 50 pounds of nitrogen as anhydrous ammonia are greater than the costs of applying the same amount of nitrogen in dry form up to about 30 acres. Beyond this acreage, 50 pounds of nitrogen in the anhydrous ammonia form can be applied at lowest cost by the 5-row applicator without storage tank. If a 5-row applicator with 1000-gallon movable storage tank is used, liquid nitrogen fertilizer costs more per acre than the dry form applied by the farmer until about 75 acres are fertilized. Beyond this acreage, the non- and low-pressure solution forms of nitrogen fertilizer become less costly than the dry form, even though equipment for the former includes the larger, more expensive storage tank.

For the farmer with 120 acres of corn fertilized at 50 pounds of nitrogen per acre, ownership of any of the three sets of equipment for anhydrous ammonia would give lower costs than dry-form nitrogen. Difference in costs between the three sets of liquid application equipment is quite large up to 200 acres. Beyond this point, the curves tend to converge, however, and finally flatten out as they approach their mathematical limit of the per acre variable costs. (If acreage were extended far enough, total costs per acre have the limit equal to the constant variable cost per acre—mainly the cost of nitrogen.) Thus, for large acreages most farmers would prefer the convenience of the large storage tank.

Largely because nitrogen in the non- and low-pressure solutions (aqua ammonia and nitrate and urea solutions) currently costs more per pound than nitrogen in the high-pressure form (anhydrous ammonia), the costs of applying 50 pounds of the former are greater than the same amount of the latter when the farmer owns his equipment. The data in figure 4 indicate that about 180 acres are necessary before non- and low-pressure nitrogen solutions generally become less costly than dry-type, when the liquid nitrogen fertilizer is applied by a 5-row applicator without storage tank. Nearly 260 acres are nec-

Figure 3.—Comparison of total costs (fixed plus variable) with labor included as cost for dry-type and high-pressure nitrogen fertilizer—50 pounds of N per acre.

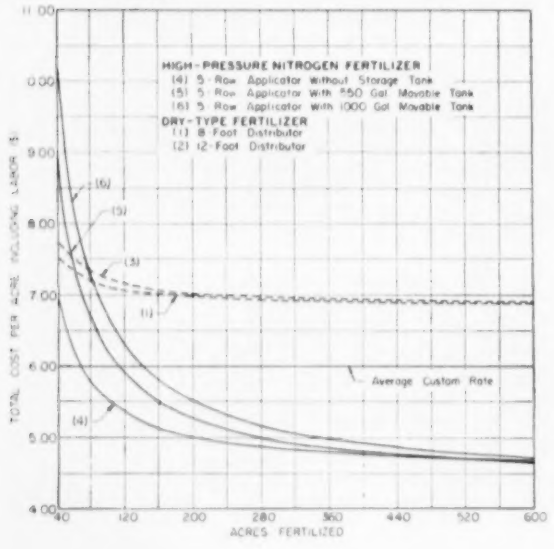
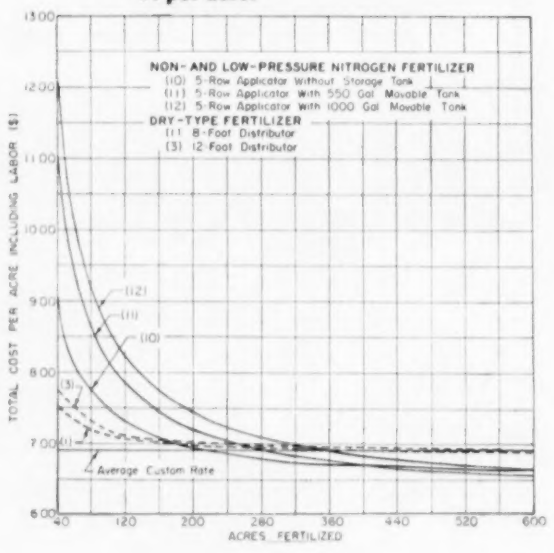


Figure 4.—Comparison of total costs (fixed plus variable) with labor included as cost for dry-type and non- and low-pressure nitrogen fertilizer—50 pounds of N per acre.



PRODUCTION
PLANS FOR NEW PLANT
PLANNING A NEW UNIT – OR A COMPLETE PLANT, MILL OR REFINERY?
PROBLEMS OF DESIGN AND CONSTRUCTION ARE PILING UP
SURE YOU HAVE GOOD ENGINEERS – BUT NOW THEY MUST COPE WITH UNFAMILIAR PROBLEMS
AND YOUR STAFF JUST ISN'T BIG ENOUGH
PRODUCTION
WHY NOT CALL IN LUMMUS, WITH ITS ARMY OF EXPERT ENGINEERS
YOU'LL GET JUST THE JOB YOU WANT AT MINIMUM CAPITAL INVESTMENT

The cartoon, of course, states the situation in very simple terms. But the basic truth is there. Building a new chemical installation, paper mill, petroleum refinery or power plant is more than a "do-it-yourself" project. Lummus has built over 700 plants throughout the world. When you are ready to build your next plant, you can call in thousands of trained men – without adding to your payroll – by calling in Lummus. And remember, your process "secret" is safe with half-century-old Lummus.

THE LUMMUS COMPANY
385 Madison Avenue, New York 17, N. Y.

LUMMUS

ENGINEERS AND CONSTRUCTORS FOR INDUSTRY

NEW YORK · CHICAGO · HOUSTON · THE HAGUE · LONDON · MONTREAL · PARIS

essary before the same size of applicator, with ownership of a 550-gallon storage tank, becomes less costly than ownership of dry-form application equipment. If, however, the non- and low-pressure nitrogen solutions decrease in price to the level of the high-pressure form of nitrogen, both liquid forms will enjoy about the same economic position. All forms of liquid nitrogen fertilizer now have, excluding extremely small acreages, a great cost advantage for high levels of fertilization (analysis is presented in a later section of this chapter). For those farmers surveyed, the modal rate of fertilization, using liquid forms, was 50 pounds of nitrogen; the second common rate was 100 pounds of nitrogen per acre; while a few farmers applied 200 pounds.

The comparisons in figures 3 and 4 include labor as a cost. When labor is available in forms and quantities to entail no cash costs, the liquid forms lose a small amount of their cost advantages at larger acreages. However, the difference is so small that it would seldom alter decisions on the methods to be used.

Custom Rates for Liquid Nitrogen Fertilizers

With the availability of custom rates, however, liquid nitrogen fertilizers can be applied on a small acreage at a lower cost than the dry form applied with farmer-owned equipment. The average custom rate per acre for 50 pounds of nitrogen in the anhydrous ammonia form was $6.00 in 1956. The comparable figure was $6.90 for aqua ammonia, and nitrate or urea solutions, the difference being mainly due to the price of nitrogen in the two forms (see figures 3 and 4). Cost of the material is added to this machine cost, in computing total charges for custom application. Most custom application is in the liquid form of nitrogen fertilizers. In the few cases where custom application of dry-form fertilizer was encountered, charges were appreciably above those for liquid fertilizers.

The farmer with a large corn acreage, or the farmer owning application equipment and storage tanks jointly, has an appreciable opportunity to spread fixed equipment costs. Ownership of machines and tanks for the application of anhydrous ammonia yields costs which are materially lower than custom rates for the same amounts and forms of nutrients.

100 Pounds of Nitrogen Applied per Acre and Associated Custom Rates for Liquid Nitrogen Fertilizers

A rate of fertilization which includes 100 pounds of nitrogen is profitable on north central Iowa farms mainly for land which has been cropped continuously in corn, without legume hay in the rotation. However, the relative advantage of liquid nitrogen fertilizers increases with the rate of application. This is true because the variable costs, which are largely the cost of nitrogen, become relatively more important than fixed costs as the rates of fertilization is increased. Hence, since the per pound cost of nitrogen and the sum of variable costs are lower, anhydrous ammonia has a lower cost than dry-form nitrogen fertilizer even for small acreages when the rate of application is as high as 100 pounds (see figure 5). The non-and low-pressure nitrogen solutions also have lower total costs per acre, for common sizes and types of equipment than the dry forms at approximately 50 acres (a corn acreage common to a large number of Iowa farms) when a storage tank does not have to be purchased.

With fertilization at 100 pounds of nitrogen per acre, custom application of either type of liquid nitrogen fertilizer is much less costly than farmer application of the dry form. (Costs of custom application for 100 pounds of N per acre are not double those for 50 pounds, since only the added nutrient costs are involved for the higher rate.) Custom application is less costly than farmer application of anhydrous ammonia up to about 120 acres (a range of 75 to 140 acres, depending on the equipment). The average custom rate is less than the cost of farmer application of non- and low-pressure nitrogen solutions up to about 320 acres for the application of 100 pounds of nitrogen per acre. Beyond the acreages mentioned above for anhydrous ammonia, the

Figure 5.—Comparison of total costs (fixed plus variable) with labor included as cost for dry-type and high-pressure nitrogen fertilizer—100 pounds of N per acre.

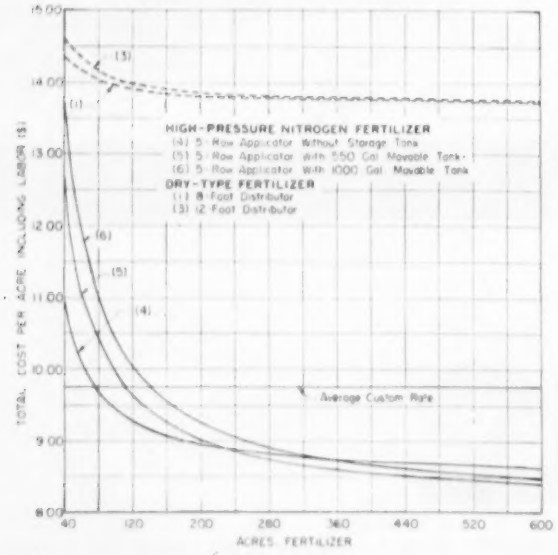
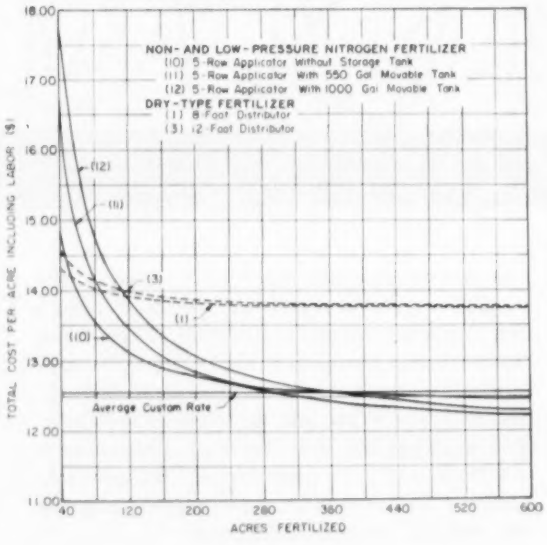

HIGH-PRESSURE NITROGEN FERTILIZER
(4) 5-Row Applicator Without Storage Tank
(5) 5-Row Applicator With 550 Gal. Movable Tank
(6) 5-Row Applicator With 1000 Gal. Movable Tank
DRY-TYPE FERTILIZER
(1) 8-Foot Distributor
(3) 12-Foot Distributor
Average Custom Rate
TOTAL COST PER ACRE INCLUDING LABOR ($)
ACRES FERTILIZED

Figure 6.—Comparison of total costs (fixed plus variable) with labor included as cost for dry-type and non- and low-pressure nitrogen fertiilizer—100 pounds of N per acre.


NON- AND LOW-PRESSURE NITROGEN FERTILIZER
(10) 5-Row Applicator Without Storage Tank
(11) 5-Row Applicator With 550 Gal. Movable Tank
(12) 5-Row Applicator With 1000 Gal. Movable Tank
DRY-TYPE FERTILIZER
(1) 8-Foot Distributor
(3) 12-Foot Distributor
Average Custom Rate
TOTAL COST PER ACRE INCLUDING LABOR ($)
ACRES FERTILIZED

cost of farmer-owned equipment falls appreciably below the cost of custom application. However, for large acreages the cost of custom application is only slightly greater than the cost of farmer application for non- and low-pressure nitrogen solutions. Farmers who wish to use this form of liquid nitrogen, because of the particular advantages mentioned later, would find that the difference in cost often would not merit machine ownership, even in the case of a large acreage.

Investment Decisions

One problem facing the farmer who expects to own and use the equipment is the magnitude of the investment required for the different methods. The data in table 2 indicate the amounts of investment required in the commonly used combinations of sizes and makes of distributing equipment and storage tanks for liquid nitrogen. The investment exceeds equipment costs for the dry form by $550 to $1,650, depending on the combinations compared. Hence, some farmers who are limited on capital may, even though they have a sizeable corn acreage, use the dry-type of nitrogen even though it has a higher per acre cost than liquid form. For example, a farmer might, if he owned the machinery, save $1 per acre on 120 acres fertilized at 50 pounds of nitrogen by using anhydrous ammonia. Still, the sacrifice of $120 in costs by using the dry-form nitrogen could be more than offset if the $500 in smaller investment requirements would give a net profit of $300 when invested in brood sows, or even in fertilizer itself. Undoubtedly numerous farmers view the alternative methods in this opportunity cost approach. This statement applies to the conditions where capital is the restricting resource in farm organization. Where labor is the restricting resource, the premium may be on liquid nitrogen fertilizer so that the limited labor can be made available for livestock or other production enterprises.

However, with the availability of custom services for liquid fertilizers, the capital obstacle to use of the newer nutrient sources is largely overcome. Use of custom fertilization makes investment in either liquid-form or dry-form equipment unnecessary, if the farmer can use capital elsewhere in his business. But many farmers are reluctant to depend on custom services because of the probability that they may not be able to get their fertilizing done at the desired time. Also, some farmers feel that since they "cannot see the product," they are not certain about the amounts of plant nutrients applied from the custom application. Growth in amount and quality of specialized custom services may, however, cause this objection to decline in the future, i.e., confidence will undoubtedly grow with experience.

Other Equipment

So few farmers use weed spray equipment in fertilization in Iowa that analysis of costs of this method is impractical. Foliar sprays are unimportant in the state and do not provide a "supplementary use" of equipment. Hope exists in the minds of farmers that corrosion problems can be overcome for spray equipment so that farmer application of solution fertilizer will become practical, even for a small acreage.

A few farmers interviewed applied solution nitrogen as a starter fertilizer in 1956. Equipment usually included a 100-gallon planter attachment on a 4-row planter, with a 300- or 500-gallon tank on a truck. As is mentioned later, some difficulty was encountered with these arrangements. However, those using the method in 1956 plan to repeat it in 1957. It is their opinion that equipment plus labor costs are about the same as for dry-form starter nitrogen fertilizer, with labor being slightly less in the first case and equipment being slightly less in the second, with the liquid nitrogen at about two cents less per pound than the dry form.

Effect on Economy of Fertilization Rate

Logically, heavier rates of fertilization are more profitable for liquid nitrogen fertilizer than for the dry type, because the variable costs of nutrients are lower for liquid- than for dry-type nitrogen fertilizer. While total costs—fixed costs plus variable costs—may be greater for small acreages fertilized by liquid nutrients (where the farmer owns the equipment), even in these cases a higher rate of application should be more profitable under the condition of lower variable costs of applying liquid nitrogen fertilizers. This relationship exists because the incremental costs of fertilization depend only on variable costs. When variable labor and power costs of equation 1 can be expressed as a function of the amount of fertilizer applied, the "total fertilizer cost" function is of the nature of equation 2 where a' is

Figure 7.—Less costly machines: fixed costs per acre for selected sizes and combinations of equipment in applying dry-type and high-pressure nitrogen fertilizer.

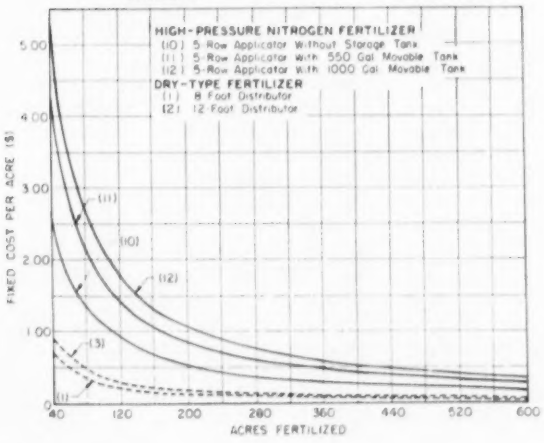
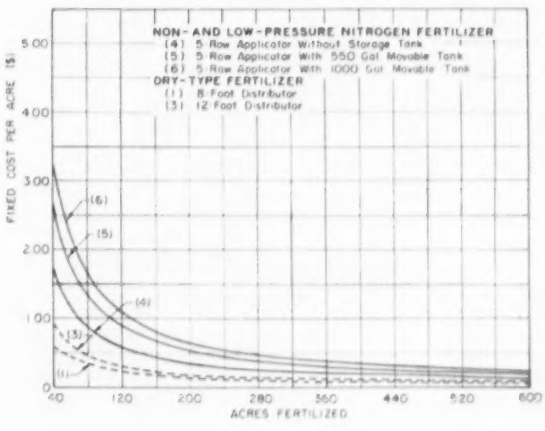


Figure 8.—Less costly machines: fixed costs per acre for selected sizes and combinations of equipment in applying dry-type and non- and low-pressure nitrogen fertilizer.



the sum of the costs per unit of nutrient, of materials, labor and power per unit of nutrient applied and M is the total amount of nutrient applied.[10]

$$(2)\quad T = F + a'M$$

Net return per acre from fertilization is at a maximum when increment in yield due to the last "pound" of fertilizer is equal to the ratio formed by dividing the price of the nutrient by the price of the product. The price of the nutrient alone is considered since, while power, labor, and similar costs vary with the number of acres fertilized, only the cost of fertilizer varies with the per acre rate of application.[11]

For example, with a price of corn of $1.40 per bushel, the nutrient/product price ratio is 8.7/140, or .062 for anhydrous ammonia; and 13.3/140, or .095, for dry-type nitrogen, using the average nutrient prices of 1956. Therefore, this form of liquid nitrogen could be used at a higher rate, or until the yield added by the last pound drops to .062 bushel of corn for the last pound of nitrogen. Dry-type nitrogen would need to be used at a lower rate; or only until the last pound of nutrient adds .095 to yield. Apparently, farmers are beginning to recognize this principle and tend to use liquid fertilizers at heavier rates.

Reflections on Use by Farmers and Dealers

Use of liquid nitrogen fertilizers is a relatively recent innovation in Iowa. Accordingly, the advantages and disadvantages of liquid carriers, in comparison to dry-type fertilizers, generally have not been determined by farmers. Additional experience in the use of liquid nitrogen fertilizers, more information on crop yields, and improvements in techniques of application will be needed before trends in use will become apparent. However, both farmers currently using liquid nitrogen fertilizers and fertilizer dealers anticipate an increase in the number of farmers using the liquid form. Also they expect the rates of nitrogen applications to increase with the increased use of nitrogen solutions. Reflections on use by nothern Iowa dealers and farmers now using liquid fertilizers are summarized below.

Comparative Farmer Opinions

The greatest proportion of liquid nitrogen fertilizer is applied on a custom basis. Where application is by farmer-owned equipment, common practice is for several farmers to own jointly the applicator and storage tank. Several hundred acres are commonly fertilized with one applicator, as is also the case for custom application by dealers. A special advantage of liquid fertilizers, emphasized by farmers, is the ease of application, cleanliness of operation and handling, and the low labor requirements. Farmers using liquid fertilizers generally like the smaller physical exertion involved. The low cost per pound of nitrogen is emphasized for anhydrous ammonia as compared with other liquid and solid forms. The average price per pound of N for farmers surveyed during June 1956 was 8.7 cents, with a range from 5.7 to 10 cents, for anhydrous ammonia. The average price was 11.1 cents for the other liquid forms, with a range from 9.5 to 15 cents per pound of nitrogen. The average custom rate of application was $2.00 per acre, with a range from $1.25 to $2.50 for anhydrous ammonia; the average was $1.10 per acre for the other liquid forms, with a range from 60 cents to $2.25. The greater charge for anhydrous ammonia evidently stems from the greater power costs in pulling a heavy tank and injecting the fertilizer deeper in the soil.

While anhydrous ammonia is used much more widely than the other liquid forms because of cost differentials, advantages expressed for other types of liquid solutions include greater safety in handling, greater speed of application and a "cleaner," odorless ingredient. It is felt by some farmers that the danger of burning plants is greater for the anhydrous ammonia, especially during dry weather, and the possibility of nutrient loss from poor soil conditions is less for the other forms of liquid nitrogen solutions. Still other farmers express the opinion that the non- and low-pressure nitrogen solutions with their high concentration as a liquid poses a greater danger to "crop burning" in dry weather if the solution contacts the plant. Application on hilly land generally is not looked upon as a deterrent in use of liquid fertilizers. However, a few believe that it is more difficult to apply aqua ammonia, nitrate and urea solutions evenly on slopes. Others believe that with concentration of nutrients nearer the surface, the loss from run-off may be greater for this form of applied nitrogen if a heavy rain occurs immediately after application.

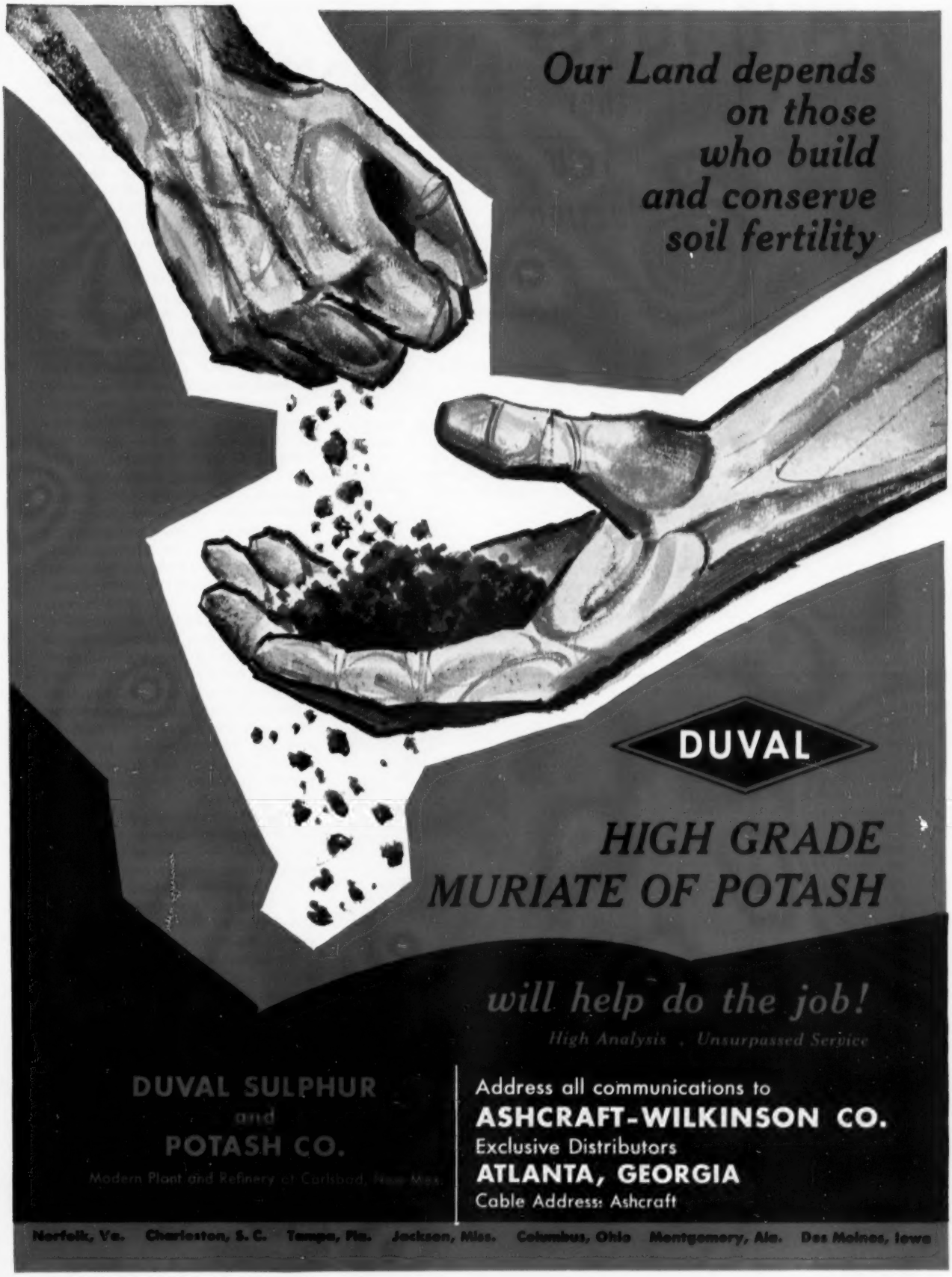
Some farmers have had difficulty with crystallization of salts in solution during cold weather. Some farmers "hypothesize" that while liquid may cost more per pound, the "effective amount" of applied nutrients paid for may be greatest for this form of fertilizer. Other hypotheses of farmers favoring nitrogen solutions are that they are more readily available to plants in dry weather; and also this form of nitrogen may serve as a better starter fertilizer. Some farmers in northern Iowa also express the opinion that while the non- or low-pressure nitrogen solutions cost more per pound, the "greater effective use of the total poundage paid for" and lower costs of application, should they own the equipment, may cause them to be as economical as, or more economical than, anhydrous ammonia. If this should prove true, some feel that the other advantages indicated above would lead to a large increase in the non- and low-pressure nitrogen solutions relative to the anhydrous ammonia. However, others express the belief that effective use of anhydrous ammonia is as great as for the other forms of nitrogen if soil is properly prepared and the individual making the application is careful in operation, considering that costs are much lower per pound of nitrogen in anhydrous ammonia under current prices for the various forms of nitrogen solutions.

Many farmers express preference for applying their own fertilizer, believing that, with inability to see the material being applied, one cannot always be certain that he is receiving the amount of nutrients paid for in liquid fertilizers. However, this belief does not relate to custom operators who are trusted by farmers. Yet, some farmers expressing their opinion say that while they would like to personally apply liquid forms of nitrogen, they cannot do so because of (a) the high cost of equipment, and (b) the higher "opportunity returns" from using limited capital in other segments of their business.

A few farmers have applied non- and low-pressure nitrogen solutions with an attachment for their planter. However, in these cases the method generally proved unsatis-

[10] *Here it is assumed that variable costs per acre are constant. The basic logic would not be changed, however, if variable costs increased in the manner represented by an exponent of more than 1.0.*

[11] *Although labor varies slightly with rate of fertilization, the added costs are negligible.*

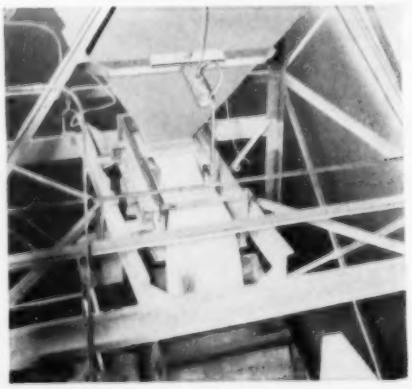

Our Land depends on those who build and conserve soil fertility
DUVAL
HIGH GRADE MURIATE OF POTASH
will help do the job!
High Analysis . Unsurpassed Service
DUVAL SULPHUR and POTASH CO.
Modern Plant and Refinery at Carlsbad, New Mex.
Address all communications to
ASHCRAFT-WILKINSON CO.
Exclusive Distributors
ATLANTA, GEORGIA
Cable Address: Ashcraft
Norfolk, Va. Charleston, S. C. Tampa, Fla. Jackson, Miss. Columbus, Ohio Montgomery, Ala. Des Moines, Iowa

TWO TOOLS

that bring further automation to *your fertilizer production*

Handling super phosphate or other fertilizer ingredients, Simplicity Gyrating Screens combine positive action with perfect smoothness to increase your output. Simplicity Gyrating Screens are mechanically vibrated, using a counterbalanced eccentric shaft which exactly counterbalances the weight of the entire deck assembly. A 3′ x 8′ Model LS Simplicity Single Deck Screen can handle as much as 50 tons of super phosphate per hour, with virtually no blinding of the screen, and a 3′ x 6′ Simplicity Model C can handle all other fertilizer ingredients at about the same speed. Every Simplicity Screen has the actual available screening area indicated by the given dimensions.

Simplicity Os-A-Veyor Feeders can be bin-hung, as shown in the photograph, or may be spring mounted. The Os-A-Veyor feeds along its entire length and allows for the use of a larger bin, thus avoiding bridging in the bin. Simplicity Os-A-Veyor Feeders have replaceable liners and can be provided with grizzly or screen sections, one or two decks, and can be totally enclosed. Simplicity Os-A-Veyor Feeders are doing a fast, efficient job for fertilizer plants throughout America.



Write us today for further information about Simplicity Os-A-Veyor Feeders, Gyrating Screens, Conveyors and Woven Wire Screen Cloth.

Simplicity
TRADE MARK REGISTERED

ENGINEERING COMPANY • DURAND 3, MICHIGAN

SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario
FOR EXPORT: Brown and Sites, 50 Church St., New York 7, N.Y.

174

factory because of corrosion. Also disc openers on planter attachments have a tendency to "ball up," resulting in a poor placement of fertilizer. While farmers are not using weed sprayers, some hoped that this equipment could eventually be designed to eliminate corrosion problems and lower the cost of farmer application for nutrients in solution. Others doubted that this would prove practical since free nitrogen escapes unless the solution is injected two to four inches into the soil.

Dealers are inclined to believe that farmers are insufficiently informed on liquid fertilizers to encourage use up to the full potential. A period of many years was required to "sell" farmers on the use of dry-type fertilizers. It is expected that liquid forms would likely follow a similar pattern, with an appreciable upturn in use where applicable. Given the uncertainty and the varied opinions in the minds of farmers, dry weather and lower product prices in the last two years are predicted to have restricted the upward trend in use of liquid nitrogen fertilizers. Since use of these nitrogen solutions has come about especially in dry years, farmers may be prone to compare their smaller yield responses with those from the dry-form fertilizer in years of good weather, thus, neglecting the weather difference. Dealers believe that more experimental data should be made available to farmers demonstrating comparative y-i e l d response for liquid and dry forms of nitrogen fertilizer in years of comparable rainfall.

Some dealers try to encourage the use of liquid fertilizer and to lessen investment requirements by making storage tanks available on a rental basis for use by farmers. Discounts to farmers doing their own hauling range from $2 to $6 per ton of nitrogen in liquid form.

Given the state of flux in opinions on the use of liquid fertilizers, it appears that increased scientific information and experience will enable farmers to make sound independent decisions. Apparently many farmers who have not tried liquid fertilizers are unaware of their comparative application costs, or the results which can be obtained from this source of applied plant nutrients.

REFERENCE CITED

1. Dumenil, L., *Nitrogen fertilizers for corn, Iowa State College Bulletin P-114, p. 841.*

Personals

W. B. Copeland, Executive Vice-President of the Smith-Douglass Company, Inc. since 1954, has resigned efefctive December 31, company officials announced today. Mr. Copeland will announce his future business plans at a later date.

He started to work for Smith-Douglass in 1932 and served in various capacities, including seven years as manager of their Streator, Illinois, plant. In 1948, he was named a vice-president and placed in charge fo Smith-Douglass Midwest operations.

* * *

A. A. Schultz, president of the **Reading Bone Fertilizer Co.,** Reading Pa., received a citation from the **Dow Chemical Co.** at a ceremony in Midland, Mich., for outstanding sales performance as a Dow distributor.

* * *

Wyman L. Taylor has been made administrative assistant to the vice president, Pacific Coast, of **Stauffer Chemical Company.** Mr. Taylor joined Stauffer in 1946. He had been Northern California sales manager, industrial chemicals, prior to his promotion.

* * *

Dr. Stacy B. Randle, state chemist at the **New Jersey Agricultural Experiment Station,** New Brunswick, has been elected chairman of the **American Chemical Society's** Division of Fertilizer and Soil Chemistry for 1957. The chairman for 1956 has been Dr. Grover L. Bridger of the **Davison Chemical Corporation,** Baltimore.

Dr. Kenneth G. Clark of the **United States Department of Agriculture,** Washington, D. C., was chosen vice-chairman, and **M. Dwight Sanders** of **Swift and Company,** Chicago, secretary. **Jesse D. Romaine** of the **American Potash Institute,** Washington, was elected to represent the division on the national Society's Council. **Travis P. Hignett** of the Tennessee Valley Authority, Wilson Dam, Ala., was named alternate.

Two signal honors—one Southern and one national—have been conferred on **Dr. Fred H. Hull,** head of the agronomy department in the **University of Florida** Agricultural Station.

Southern Seedmen's Association has named him Man of the Year and he was one of 12 in the United States to be made a fellow of the **American Society of Agronomy.**

* * *

Growers Fertilizer Cooperative, Lake Alfred, Fla., announces the appointment of **Dr. I. W. Wander** as secretary-general manager, effective January 1, 1957.

Dr. Wander comes to Growers after 10 years as soil chemist with the Citrus Experiment Station, Lake Alfred. During this time he has carried on research relating soil conditions with citrus nutrition. A number of publications in both national and local journals resulted from this research.

Dr. Wander recently returned from Costa Rica where he assisted the Costa Rican Government's Ministry of Agriculture. This assistance consisted of making plans for future research to provide a more balanced fertilization of coffee plantations.

Donald L. LeCureux has been named assistant manager of **The American Agricultural Chemical Company's** Saginaw, Mich., sales office. Formerly, he was a salesman for the Saginaw office.

* * *

Ed Burgers, Jr., sales promotion manager, has been appointed Eastern sales manager of **Kraft Bag Cor-**

Benjamin M. Holt, appointed by American Potash & Chemical to the newly created post of Project Director of the Planning and Development department. Not shown, Henry deArmond, promoted from assistant treasurer to administrative assistant.

Robert B. Lenhart, newly appointed sales representative in the Northeast and Canada for Potash Company of America.

Warren E. Johnson, manager of chemical sales for US Industrial Chemicals, who has just had alcohol sales added to his responsibilities. He has been with USI since 1940.

The Frank G. Hough Co. has just announced these appointments: Left, Robert L. Knox and Herman R. Brown as assistant sales managers; right, Robert D. Schwartz as an assistant to the advertising manager.

poration. He was for several years sales representative in the St. Louis area before coming to the home office, New York.

* * *

Appointment of **Thornton F. Holder** to the post of director of research for **Diamond Alkali Company,** Cleveland, Ohio, was announced by president **John A. Sargent.** The appointment is effective immediately. Mr. Holder replaces **Dr. Albert W. Meyer,** who has resigned.

* * *

Ned I. Malcolm has joined **Hyster Company** as sales promotion representative based at the Danville, Illinois, plant, according to **Raymond L. Howerton,** assistant manager, sales promotion department, headquarters, Portland, Oregon. In this newly created assignment, Mr. Malcolm will coordinate promotional programs in the Eastern industrial truck division and will assist Hyster's Eastern division dealers in formulating local promotional programs.

Right, John M. Wallace, now manager of the Eastern sales division of Werthan Bag; William J. C. Leslie who has joined Werthan's sales division.

Bemis Bro. Bag Company announces these changes: Left, F. C. Chenault who retires end of this month after 40 years of service; L. E. Pounders, who will succeed him as manager of Memphis plant and sales division. Not shown, T. M. Scruggs, who has retired and Ray P. Perry who succeeds as manager of the Visinet mill.

C. Frank Walter, left; J. B. Copeland, center; Doyle Smith, who have been appointed sales representatives for the Grand River Chemical Division of Deere & Company. The appointments were announced by salesmanager John R. Taylor, Jr.

CHANGES

A realignment of the Eastern sales department of **American Potash & Chemical** into two operating groups has been announced by **William J. F. Francis,** vice-president in charge of sales.

Under the new arrangement the department will operate as a heavy chemicals division and an industrial chemicals division. **Ed M. Kolb** has been named as general sales manager of the heavy chemicals division, while **Dr. Al J. Dirksen,** formerly director of AP&CC's market development department, has been appointed general sales manager of the industrial chemicals division. Their headquarters will remain at the company's Eastern general sales office in New York.

William M. Clines, formerly Western sales manager, was named general sales manager, Western, to handle all company sales in the Western area. Clines will continue to headquarter at AP&CC's executive offices at Los Angeles.

The heavy chemicals division will be responsible for AP&CC's Eastern sales activities in borax, potash and sodium sulfate (salt cake), as well as the administration of the Company's export department and the British subsidiary, Borax & Chemicals, Ltd.

The new industrial chemicals division will handle company Eastern sales for lithium, boron, Tronacarb, electrochemicals such as chlorates, perchlorates and manganese dioxide, as well as all new product marketing.

* * *

Chemway Corp., New Brunswick, N. J., has acquired **Carac Corp.,** Freeport, N. Y., manufacturer of crop chemicals and garden fertilizers.

* * *

International Minerals & Chemical New York office moved last month to its larger quarters, having leased the 27th floor of the new building at 485 Lexington Avenue, which is easier of access to out-of-town visitors.

In 1958 the corporation plans to transfer national headquarters from Chicago to greatly enlarged offices and research facilities now being built in Skokie, a Chicago suburb.

* * *

US Borax & Chemical, in a move to bring together the offices of its several divisions, has leased the 8th and part of the 9th floor at 50 Rockefeller Plaza, New York. The new offices are expected to be ready about June.

OBITUARIES

George Ede Harike, 48, chemical research engineer for Tennessee Corporation, died in an Atlanta hospital November 29 after a short illness.

Dr. George Moore, 87, director emeritus of Shaw Gardens, St. Louis, and perfecter of a method to enable crops to use atmospheric nitrogen, died in St. Louis November 29.

Fine Safety Record

The Los Angeles plant of American Potash & Chemical Corporation recently completed three years without a lost-time accident, the longest no-accident record ever set by one of the company's facilities.

To commemorate the event, the company held a dinner party which was attended by approximately 60 employees of the AP&CC Los Angeles plant at which a plaque was presented to participating personnel by Russell Sunderlin, plant manager of the facility.

Oregon Dealer Conference

Pacific Northwest Plant Food Association has worked out a fertilizer dealer program which will be held January 17 in Withycombe Hall, Oregon State College. The program is to be highly practical in nature.

You save money with LION in your fields

LION BRAND AMMONIUM NITRATE IS A LOW-COST SOLID NITROGEN FERTILIZER

FOR LOW-COST NITROGEN, LION is the brand. Lion Ammonium Nitrate is guaranteed to contain 33.5% nitrogen, which means lower-cost nitrogen for your crops . . . more for your money in bigger crop yields.

FOR MORE PRODUCTION, Lion Ammonium Nitrate contains TWO kinds of plant nitrogen. *Quick-acting* nitrate nitrogen that gets crops started fast . . . and *long-lasting* ammonia nitrogen that resists leaching and feeds your crops steadily during the important growing months that follow.

FOR EASIER SPREADING, Lion Ammonium Nitrate is in pellet form. These pellets are specially coated to withstand caking . . . then packed in specially lined, moisture-resistant bags. Here's double assurance Lion brand will flow freely, spread evenly after shipment or storage.

MADE BY WORLD'S LARGEST. Lion Brand Ammonium Nitrate is made by Monsanto Chemical Company, world's largest producer of prilled ammonium nitrate—and *your* most reliable source of *low-cost* nitrogen. Save money. Buy *Lion!*

DISTRICT SALES OFFICES: Lion Oil Building, El Dorado, Ark.; 1220 National Bank of Commerce Building, New Orleans 12, La.; 1401 Peachtree St., Atlanta 9, Ga.

GROW MORE PROFITABLY . . . Weed Killers • Brush Killers • DDT and Parathion Insecticides • Medo-Green® Silage Preservative • Phosphates (Liquid and Solid)

MONSANTO

MONSANTO CHEMICAL COMPANY • ST. LOUIS 1, MISSOURI

"DOLOXIDE"

Pulverized Magnesium Calcium Oxides

Used by nearly all fertilizer plants to condition - - - -

- Alkaline Grades
- Pulverized Ammoniated Grades
- Granulated Ammoniated Grades

THE MOORES LIME CO., SPRINGFIELD, OHIO, U.S.A.

CALL ARMOUR

greatest name in fertilizers

READY TO SERVE YOU WITH

31 factories and offices

PHOSPHATE ROCK • TRIPLE SUPERPHOSPHATE

SUPERPHOSPHATE • SHEEP MANURE

ARMOUR FERTILIZER WORKS

GENERAL OFFICE, P.O. BOX 1685, ATLANTA 1, GEORGIA

ALABAMA

Santa Claus beamed on Aliceville late last month thanks, among others, to **Valley Fertilizer Co.** who took part in the festive occasion ... including a big parade, in which Valley had a float entitled Winter Night.

* * *

Alabama Fertilizer Co., Montgomery, has been acquired from the estate of **John R. Hudson** by **Menza L. Head,** from 1925 through 1949 vice-president and manager of the enterprise.

CALIFORNIA

Ammonia Chemical Corp. this month was slated to begin construction of its $5,000,000 plant near Huron, in the San Joaquin Valley. This is a joint venture with **Monterey Oil Company,** which is expected to be in operation some time in late Summer. According to J. H. Finney, president, the production of anhydrous ammonia will draw 5,000,000 daily cubic feet of natural gas from the pipeline which was a big factor in location choice. San Francisco offices will be opened at 1044 Fulton Street.

* * *

Shell Development expects to complete this Fall the $1,000,000 research center at Modesto, at which time the concern's agricultural research will be concentrated under one roof, according to **Dr. H. Gershinowitz,** president. The combined laboratory will be under the charge of **S. H. McAllister,** director of the division; the biological work will be under the present Modesto lab manager, **Dr. Roy Hansberry;** present director of the Denver lab, **Dr. K. E. Marple,** will direct chemical research; **Dr. E. F. Feichtmeir** will direct products application research.

CONNECTICUT

Monsanto has completed and put into service bulk storage capacity at New Haven's waterfront, for more than 1,500 tons of 66 degree Baume sulphuric acid, which is shipped there from their Everett, Mass., plant. Monsanto ships liquid sulphur from Louisiana by tanker, transfers to their own barge at New Haven, en route to Everett, which returns acid to New Haven for transfer to tank-trunk.

FLORIDA

American Cyanamid are certainly not going to have **"neighbor trouble"** at their Brewster triple superphosphate plant, if thorough precautions can prevent it. The plant is due to be in production the middle of this year, but a study of air and water pollution is in progress, and they are setting up a network of monitoring outposts, like radar defense, which will keep a constant check on the situation.

These outposts will not only know if Cyanamid's plant is offending. They will also record offenses by other plants in the area—so the responsibility can be pinned where it belongs, should the need develop.

To cap this, a garden of plants sensitive to pollution will be maintained.

Last, but far from least, Cyanamid is letting the neighbors know all about this set-up so they'll be less apt to blame the plant for any vagrant odors that may drift over Brewster and adjacent areas.

* * *

Diamond R, Winter Garden, has completed its development program which included, first, doubling of storage, then the purchase of a new 12 bin cluster hopper mixing unit from Clements, and finally the installation of a brilliant Diamond R neon sign on the roof, which glows from dark to dawn.

* * *

Na-Churs Plant Food of Marion, O., has opened and has in operation its plant at Winter Garden.

* * *

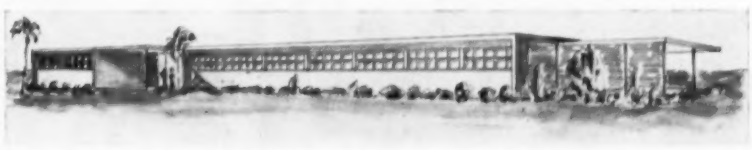
Everglades Fertilizer caught a blaze in time, and it was extinguished without damage to buildings or goods.

MASSACHUSETTS

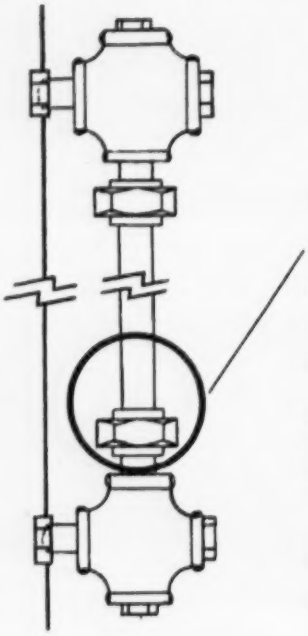
Hubbard-Hall Chemical Co., with offices in South Deerfield, has been formed by the merger of four fertilizer concerns, all doing business in the Northeast. Included are **Old Deerfield,** South Deerfield, established 1926; **Apothecaries Hall Co.,** East Windsor, Conn., originally established as a drug store, but in fertilizer manufacture for 35 years; **Rogers and Hubbard,** Portland, Conn., in fertilizer manufacture since 1878; **Woodruff Fertilizer and Chemical,** which has been in the business for some 20 years at North Haven, Conn.

The approval of stockholders was slated to be gained by the first of

Architect's drawing of a new Link-Belt Company plant to be built in Montebello, Calif., about 10 miles east of downtown Los Angeles, to replace and expand the company's facilities at 361 South Anderson Street, Los Angeles. Ground will be broken next spring and it is expected the plant will be completed and in operation by November, 1957.



Drawing of the new office building now being built in Ridgewood, Fla., for the Florida Phosphate Division, Davison Chemical Company Division of W. R. Grace & Co. Designed and equipped to house the 65 persons on the administrative, office and engineering staff, the new one-story building will be 170 feet long and 70 feet wide with 10,500 sq. ft. of floor space. Of masonry block construction, the building will be air-conditioned and centrally heated. Wellman Construction and Engineering Company of Lakeland, Fla., is in charge of construction, which is scheduled to be completed by March, 1957.



TULL designed to save you money
NITROGEN SOLUTION SYSTEM
Gauge Glass Fixtures

Simple, easy to clean, inexpensive

The combination of a Tullco modified union and rubber bulb gasket guarantees a leak-proof connection.

We have the entire system in stock—buy as a complete unit or in part.

Send for your booklet "The Installation and Operation of a Nitrogren Solution System" to P. O. Box 4628, Atlanta 2, Georgia.

J. M. TULL METAL & SUPPLY CO., INC.

285 Marietta St., N.W. JAckson 5-3871 Atlanta, Ga.

Branch Warehouses

JACKSONVILLE MIAMI TAMPA

STEDMAN

FERTILIZER PLANT *EQUIPMENT*

Established in 1834

- All Steel Self-Contained Fertilizer Mixing and Bagging Units
- Complete Granulating Plants
- Batch Mixers—Dry Batching
- Pan Mixers—Wet Mixing
- Tailings Pulverizers—Swing Hammer and Cage Type
- Dust Weigh Hoppers
- Vibrating Screens
- Acid Weigh Scales
- Belt Conveyors—Stationary and Shuttle Types
- Batching Systems
- Bucket Elevators
- Hoppers and Chutes

STEDMAN FOUNDRY & MACHINE COMPANY, INC.

Subsidiary of United Engineering and Foundry Company

General Office & Works: AURORA, INDIANA

this month, after which officer organization will be announced.

MISSISSIPPI

The Fluor Corporation which, as reported here last month, has been awarded the contract to design, engineer and construct the Coastal Chemical plant at Pascagoula, tells us it will be the first completely integrated phosphate fertilizer plant in the State utilizing basic materials, and the first in the US to use the St Gobain process.

* * *

Sangamon Grace Ammonia, Chicago, has been granted a Mississippi charter to deal in fertilizers and crop chemicals.

* * *

T. A. Quinn Chemical and Fertilizer has been chartered at Yazoo City, with $25,000 capital stock.

MISSOURI

Semo Liquid Fertilizer Corp., Charleston, has been reorganized under the experienced ownership of **John Wilson** in cooperation with several gin plant operators in the area. The plant has been completely re-designed and equipped by **Ellsworth Equipment & Engineering** Co., Indianapolis, with a Hydro-Cycle system which provides 15 hourly tons of complete liquid fertilizer.

* * *

Chemagro's new $2,000,000 plant at Kansas City will be in the almost exact center of their sales market, and is rated locally as the first "sizable basic chemical" operation in that area.

NEW YORK

Phosphate Rock Export, New York City, has changed its capital stock structure to 6,000 shares from 300 no-par shares.

NORTH CAROLINA

Smithfield Fertilizer Co., Inc., has been chartered at Smithfield, with $100,000 authorized stock. Incorporators: J. Q. Pernell, Sr.; Billy Wiggs; Woodrow Jones.

* * *

OHIO

Zehr and Company are in the proces of building a new complete liquid fertilizer plant at Archbold.

* * *

UTAH

US Steel's Columbia-Geneva works is scheduled to go into operation this month, with its **Montecatini** low-temperature process. It is slated to turn out more than 70,000 annual tons of ammonium nitrate, and is the only such facility integrated with the steel industry on the North American continent. **Blaw-Knox** built it. Cost was $18,000,000.

* * *

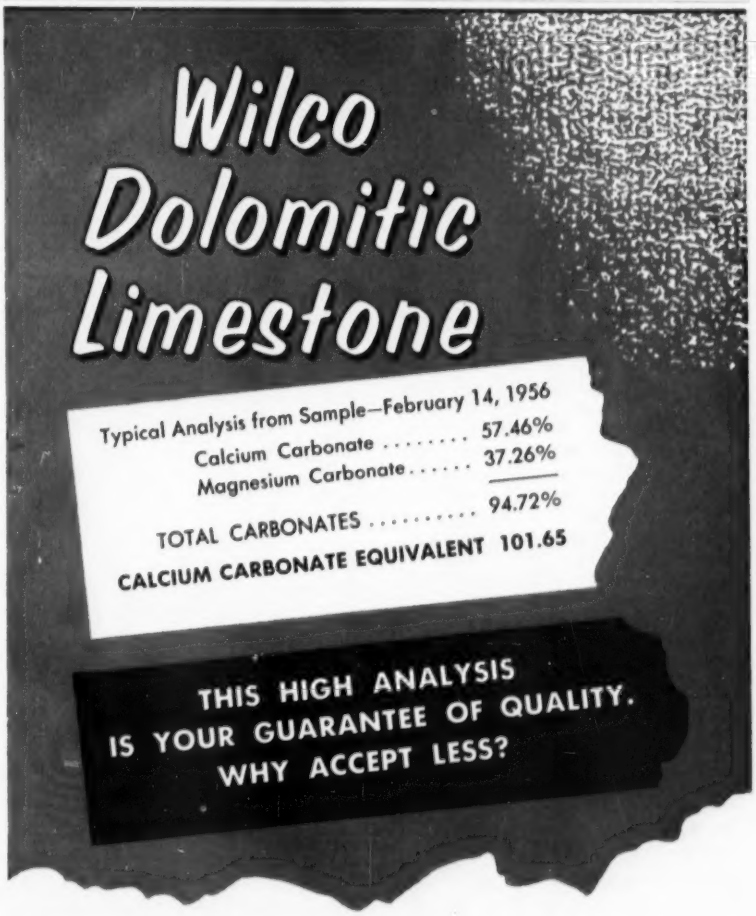
Garfield Chemical & Manufacturing has brought to $14,000,000 its investment in sulphuric acid production at Garfield, with the new contact plant, build by **Leonard Construction** subsidiary of **Monsanto.** In addition to this, the gas-cleaning plant was enlarged, and three **Chicago Bridge & Iron** heat exchangers were installed as part of the $2,750,000 expansion. Garfield, as our readers know, is a joint enterprise of **American Smelting** and **Kennecott Copper.**

VIRGINIA

Virginia-Carolina's outdoor advertising will be timed to the seasons in mid-Western and Southern states, under the direction of their advertising agency, **Sidney Noble** of New York who also handle their farm magazine, radio, newspaper and direct mail advertising.

AUSTRALIA

Chase Syndicate, Los Angeles, USA, has bought from the West Australian government 1,500,000 acres of wasteland on which a fertilizer plant, a meat works and the raising of livestock will take place in what seems to be a thoroughly integrated operation. The land was acquired at four shillings the acre, and total development cost is set at 14,000,000 pounds Australian.



WILLINGHAM-LITTLE STONE COMPANY

1323 Fulton National Bank Building

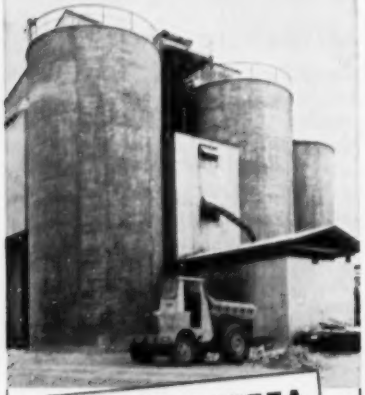
Atlanta, Georgia

Phone JAckson 3-5591

DOLOMITIC WILCO LIMESTONE

serving the south's fertilizer industry for more than 41 years

Cut Material Wastes and Handling Costs



with a **MARIETTA** STORAGE SYSTEM Designed to your needs

Inefficient storage and handling of bulk materials runs costs up and production down. Let Marietta help you turn this cost factor into a profitable operation with a storage and handling installation engineered to the job.

Adaptable Marietta concrete silos will handle storage of any material from lump coal to core sand, chemicals, fly ash and etc. Their pre-cast solid or Air Cell concrete stave construction is sturdy . . . durable . . . fireproof. Moisture-resistant interiors eliminate costly waste or spoilage. Marietta storage silos are built with an extra strength factor for mounting any type of intake, discharge or materials handling equipment.

Whether you require 1 or 40 units . . . a complete new system or an addition to your present capacity . . . it will pay you to consult Marietta.

DON'T FIGHT SHORTAGES Use Marietta concrete stave silos.

Write for informative booklet on how Marietta plans, engineers and erects modern storage-handling systems for industry.

THE Marietta CONCRETE CORPORATION Marietta, Ohio

40 YEARS

BRANCH OFFICES: Baltimore 21, Md., Charlotte 6, N.C., Nashville, Tenn., Jamestown, N.Y.

INDIA

Vitro Engineering Division, New York, have been appointed as technical consultants for the $46,000,000 Nanga fertilizer and heavy water plant, which will have a capacity of 200,000 annual tons of ammonium nitrate fertilizer.

NETHERLANDS

Staatsmijnen urea plant, Limburg, is operative. It will soon be expanded to a capacity of 50,000 annual tons. It is operated in conjunction with their nitrogen-fixation works.

Louis H. Wilson, NPFI information director, and recently elected president of the Agricultural Relations Council, shown as he presents the Soil Builders Awards to Frederic B. Knoop, right, of The Farm Quarterly and Ralph Sandlin Yohe, center, of Prairie Farmer. These awards are made annually by NPFI at the American Agricultural Editors Association convention.

NPFI Prominent In Agriculture Meetings

The National Plant Food Institute played a prominent role in the series of important agricultural meetings held in Chicago, November 23-29.

C. T. Prindeville, president of the Institute, gave a welcome talk to the guests at the Institute-sponsored annual banquet for members and associate members of the National Association of Television and Radio Farm Directors, November 25. Approximately 250 television and radio farm directors and associates from all parts of the United States attended the banquet which culminated a 3-day meeting of the group.

Louis H. Wilson, secretary and director of information for the Institute, was elected to a 3-man Associate Member Advisory Committee to work with officers and the executive committee of NATRFD. Mr. Wilson also will head the Steering Committee for the NATRFD 1957 Spring Meeting to be held in Washington, D. C.

Delbert L. Rucker, director of publications for the Institute, served on a committee to select a revised emblem for NATRFD.

Mr. Wilson was elected president of the Agricultural Relations Council at its annual meeting November 29. This group is an organization of key professional agricultural public relations personnel, of which Mr. Rucker also is a member.

Mr. Rucker supervised an Institute-sponsored exhibit of the organization's activities at the annual meeting of the American Society of Farm Managers and Rural Appraisers November 25-27.

Georgia Society Meeting Athens, Jan. 15-16

Meeting jointly, as usual, with the Georgia Section ASA, the Georgia Plant Food Educational Society will assemble January 15 at the University of Georgia's Continuing Educational Building. It will be the society's fourth annual meeting.

The program which begins at 1 o'clock January 15 will discuss ways and means to help Georgia move an additional 1,258,000 tons of mixed fertilizer. The banquet that evening will be addressed by Monroe M. Kimbrel, president of the Georgia Bankers Association.

Speakers for the meeting include Dr. Russell Coleman, NPFI, as well as leading men from the College of Agriculture, the State Department of Agriculture, and Clarence Walker, a very entertaining humorous speaker from the Coca-Cola Company. Presiding will be President J. E. Nunnally and vice-presidents John L. Cope and W. J. Cook. J. Fielding Reed is secretary-treasurer.

National winners of 4-H Field Crops Awards for 1956, shown with Hugo Riemer, president of Nitrogen Division, Allied Chemical & Dye. Nitrogen Division is official donor to the Field Crops program, providing $300 scholarships to six equal national winners, trips to 4-H Club Congress to state winners, and medals to county winners. Pictured are (standing): Otis Young, Jr., Cortland, N. Y.; Milton McDaniel, Brinkman, Okla.; Mr. Riemer; John Lancaster, Glendo, Wyo.; and Harold Toepper, Peotone, Ill. Kneeling are Joe Peine, Greeley, Kansas, and Kenneth McEachern, Hale Center, Texas.

MIDWEST AGRONOMISTS CONVENE IN CHICAGO, FEBRUARY 14-15

Proper fertilizer placement in profitable crop production will receive special attention at the forthcoming annual joint meeting of Midwestern agronomists and fertilizer industry men at the Edgewater Beach Hotel, Chicago, Thursday and Friday, February 14 and 15.

The program will also headline reports on new fertilizer research.

An attendance of more than 600 is expected at the two-day meeting sponsored by the Middle West Soil Improvement Committee.

Dr. Kermit C. Berger, University of Wisconsin, will be chairman. Sessions will open Thursday afternoon and run through Friday noon.

The visiting agronomists and industry men will be welcomed by Richard E. Bennett, MWSIC president, and Zenas H. Beers, executive secretary.

The Thursday afternoon program will include reports on fertilizer research by agronomists from Purdue University, Michigan State University, the University of Missouri and South Dakota State College of Agriculture.

Of particular interest will be a presentation on "Fertilizer in Profitable Farming," by Walter Mumm, of the Crow Hybrid Corn Co., Milford, Ill. Mr. Mumm will illustrate his addres with color slides showing profitable crop response from the use of fertilizer.

The Friday morning program will be devoted to reports, discussions and a question and answer session on Proper Placement of Fertilizer in the Row for Corn.

Dr. A. J. Ohlrogge, Purdue University, will lead off with a talk on "What Are the Fertilizer Needs of Corn?" W. H. Garman, director of economic relations, National Plant Food Institute, will discuss "Experiment Station Recommendations on Fertilizer Placement."

W. C. Hulburt, agricultural engineer, Agricultural Research Service, USDA, Beltsville, Md., will report on the farm mechanization factors in proper placement of fertilizer. He will review the equipment now available from implement manufacturers for placement of fertilizer in the row.

A discussion on "A Proper Fertilizer Placement Promotion Plan" will be led by Z. H. Beers.

Representatives of farm implement manufacturing companies will be present at the meeting.

Recommendations by agronomists for fertilizer grades and ratios for 1957 in the various Midwestern states will be presented by Dr. Kermit C. Berger.

Agronomists from 13 Midwestern states will attend two-day sessions of the North Central Soils Research Committee at the Edgewater Beach Hotel on Tuesday and Wednesday, February 12 and 13, preceding the joint meeting.

Z. H. Beers, MWSIC executive secretary, urges fertilizer industry men and agronomists to make immediate arrangements for room reservations at the Edgewater Beach Hotel.

Meggs Heads Oklahoma Society

James E. Meggs, sales manager for Oklahoma City's Nichols Fertilizer and Chemical company, has been elected president of the Oklahoma Plant Food Educational Society.

Mr. Meggs, who served as vice-president last year, was elected at the joint annual meeting of the OPFES and the Crops and Soil Conference at Oklahoma A&M College, Stillwater, November 28 and 29.

The new president graduated from Oklahoma A&M in 1947 and taught in the agronomy department there until 1949 when he entered the seed business. He joined the Nichols company in 1951.

The Oklahoma Plant Food Educational Society is composed of representatives of Oklahoma A&M, fertilizer industry, fertilizer dealers, bankers, farmers and other individuals interested in increased soil fertility. Purposes of the Society are to promote adequate and correct use of plant foods; improve Oklahoma agriculture by increasing soil fertility; encourage conservation and proper cultural practices; cooperate with all private and governmental agencies to promote better use of plant foods by Oklahoma farmers; and to do whatever else is necessary to help bring about better crops and increased farm income in Oklahoma.

Happy New Year and thanks for your greetings

Off-Season Fertilizer Potentials..... in the Southeast

by L. B. Nelson
Head, Eastern Soil and Water Management Section
Soil and Water Conservation Research Branch
Agricultural Research Service, U.S.D.A.

Most fertilizer sales are made during the spring months. This spring sales peak works a hardship on the entire fertilizer industry. Farmers have less choice of fertilizers during the rush period and frequently have to select grades that do not meet their specific needs. The spreading job also comes at a period when there are large demands upon the farmers' time. Thus there are good reasons favoring off-season application.

On the other hand, these reasons are not in themselves sufficient to justify a change. Off-season application must either do a better job of meeting the nutrient requirements of a growing crop or it must give nearly equal returns to spring-applied fertilizer on the following season's crop.

Meeting the nutrient requirements of a growing crop offers the greatest justification in the Southeast. I am referring specifically to applications of fertilizers in late summer and early fall to seedings of legumes and grasses and small grains, maintenance applications on established hay and pastures, and applications on winter vegetables and horticultural crops. The need already has been well established and off-season applications are being recommended by the various State Experiment Stations and State Extension Services.

Let us examine now the potentialities for increased off-season application on these crops. Can we develop a greater outlet for off-season fertilizers? We can dismiss possibilities for much increase in fertilizer use on vegetable and horticultural crops, cotton and tobacco, because almost 100 percent of their acreage is fertilized and at high rates. Any increase here would have to be associated with an increase in the planted acreage.

It's a different story on hay and pasture crops. Few people recognize just how huge this potential actually is.

Preliminary data from the 1954 Agricultural Census indicate that only a portion of the hay and cropland pasture acreage in the Southeast receives fertilizer. Mississippi uses fertilizer on only 19 percent of the hay and cropland acreage; Arkansas, 10 percent; South Carolina, 38 percent; North Carolina, 33 percent; Georgia, 38 percent; and Tennesee, 15 percent. In these six states alone, 11 million acres of hay and cropland pastures goes unfertilized.

Assuming that the unfertilized acres in these six states received the same fertilizer applications as the fertilized acres of the same crops, then we would need 36,000 tons more nitrogen, 188,000 tons more P_2O_5, and 146,000 tons more K_2O than is now being used. Other Southeastern States probably would follow the same pattern. This represents a tremendous and untapped potential for increased fertilizer use, and furthermore, quite a percentage of the fertilizer on hay and pastures could be applied during late summer and fall months.

Some increase in fertilizer use also could be made on fall seeded small grains, but not as much as on hay and cropland pastures. About 75 percent of the small grain acreage in the Southeast already receive fertilizer.

Although a great potential exists, there are a number of obstacles in the way. Returns in dollars and cents from fertilizer on hays and pastures would not be as great as from cotton, tobacco, vegetable crops and the like. Also, many Southeastern soils are too acid to permit good growth of legume forages and efficient fertilizer use. For example, reports from four State Soil Testing Laboratories in the region show that from 54 to 72 percent of the soils tested were too acid to grow legumes. Use of lime has been declining steadily and both surface and subsoils are becoming more acid.

Lack of liming thus presents a real problem, one that must be reckoned with one way or another. Offhand, it looks like a lot of fertilizer dealers will need to promote liming in order to build their fertilizer sales.

Possibilities for applying fertilizer in the fall for use by the next summer's crop (over-winter storing of fertilizer in the soil) appears to offer only limited possibilities in the Southeast. The reason is simple. On most soils in the Southeast, fertilizers applied in the fall do not give as good returns as fertilizers applied in the spring. This statement of course does not apply to phosphate rock.

Phosphorous fixation works against fall application of soluble phosphorous fertilizers. Research data invariably indicate that superphosphate applied a few months in advance is much less effective than that applied immediately before a crop is planted. One way to alleviate phosphorous fixation and improve the residual availability of superphosphate fertilizer is to lime. Adequately limed soils should make off-season application of superphosphates much more feasible and encourage use of larger phosphate applications.

Leaching of potassium from soils can reduce the efficiency of off-season potassium applications. Research men in the Southeast believe that potassium losses are not as great as previously considered except on sandy soils. However, more research data are needed before fall application of potassium could be recommended.

Nitrogen not taken up by a growing crop is subject to over-winter leaching in the Southeast. Water moving through the soil takes nitrates with it and conditions are right most years for loss of nitrates. Soil temperatures are high enough in the fall and early spring to favor nitrification, precipitation is high enough to cause leaching. Data obtained in the drier areas of country showing equal benefits from fall- and spring-applied nitrogen thus are not at all applicable to the Southeast except during low rainfall years.

Preliminary data from a number of experiments in the Southeast show that fall-applied nitrogen is about ¾ as effective as spring-applied nitrogen on the following corn crop. These initial results would indicate that over-winter nitrogen losses are not as serious as originally thought. However, they are of a

Presented before the First Annual Soil Fertility Conference, Atlanta, Georgia, November 2, 1956.

Complete **GRANULATION UNITS** Turn-Key

Practical and Economical

SUPERPHOSPHATE PLANTS

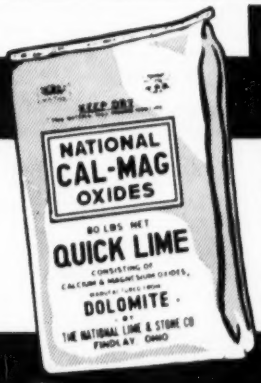
TYLER CHAIN MILLS **ELEVATORS** **BUCKET CLEANERS**

COMPLETE ENGINEERING SERVICE

Write Us Today About All Your Equipment Requirements

LONGHORN CONSTRUCTION CO.

P. O. BOX 336 SULPHUR SPRINGS, TEXAS TEL. TUX 5-2214



NATIONAL CAL-MAG OXIDES

NOW IN TWO SCREEN SIZES

MgO 40.39 – CaO 58.07 – TNP 203.88

Superior for Dehydrating, Neutralizing, and Curing factors in the preparation of effective fertilizers.

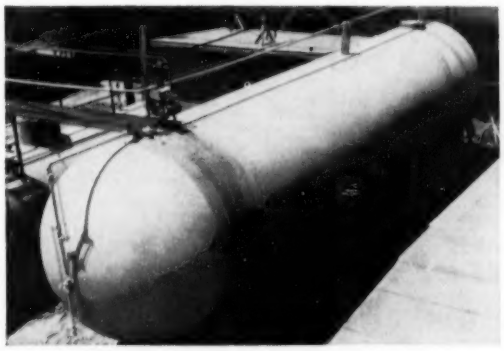
PROMPT SHIPMENTS

Three railroads serve our Carey, Ohio, plant — assuring prompt delivery — everywhere.

WRITE FOR COMPLETE INFORMATION TODAY! Dept. CF

We Also Produce
DOLOMITIC HYDRATED LIME (165 TNP)
and
KILN DRIED RAW DOLOMITE (107 TNP)
Screened to size

The NATIONAL LIME and STONE CO.
General Offices • • • • • FINDLAY, OHIO



WELDED ALUMINUM TANKS

● With over a century of experience in metal fabrication, we were pioneers in the fabrication of aluminum, building the first aluminum tank for nitrate solutions. (Incidentally, this tank is still in service.)

We can supply you with welded aluminum tanks or pressure vessels for the storage or processing of agricultural chemicals, built to ASME code specifications to meet all insurance requirements.

Conventional or special design tanks, shop built up or field erected, using flat, flanged and dished, or hemispherical heads, can be built to your specifications. Write for a copy of our booklet, *Tanks and Equipment for the Plant Food Industry.*

Elevated Tanks, Pressure Vessels, Chemical and Processing Equipment from Aluminum, Stainless and Carbon Steel, Monel and Other Alloys.

R. D. COLE MANUFACTURING CO.
COLE
NEWNAN, GEORGIA

R. D. COLE MANUFACTURING CO.
NEWNAN, GEORGIA

Alex. M. McIver & Son

BROKERS

Specializing

SULPHURIC ACID

Ground Cotton Bur Ash, 38/42% K_2O Potash.

Nitrogenous Materials

Castor Pomance

Urea, 45½% and 46% Nitrogen

DI-N-CAL—20.5% Nitrogen
(Calcium Ammonium Nitrate)

Representatives

Morgan Brothers Bag Company, Inc.

Bags—Paper and Textile

Ammoniated Base and Superphosphate

Dolomitic Lime
(42-44% Magnesium Carbonate)
(54-56% Calcium Carbonate)

POTASH

PEOPLES OFFICE BUILDING
Charleston South Carolina
Phones: 3-4828 and 3-4829

magnitude to rule out fall application for the following season's crop. More data are needed before definite conclusions can be drawn.

Summing up, it appears that a great potential exists for off-season application of fertilizers in the Southeast on hay and pasture crops and small grains. Off-season applications for these crops should follow recommendations already being made by the individual State Experiment Stations and Extension Services. There does not, however, appear to be a very great potential in applying fertilizers in the fall for crops to be planted the following spring in the Southeast.

Network Musical Promotes Crop Chemicals

Crop chemicals and penta wood preservative will be promoted on a new radio program, The Red Foley Show, under the sponsorship of The Dow Chemical Company, Howard Sheldon of Dow's agricultural chemical merchandising section reports. The half-hour show will be heard each Saturday at 12:30 p.m. (CST) over the ABC network beginning Jan. 19.

CROP CHEMICALS

Pesticide Sales Hit Record High In 1956

Pesticide chemical sales in 1956 reached an estimated $250,000,000 at the basic producers' level, a new, all-time high for the industry. This is 25 percent higher than the 1955 producers' sales of $200,000,000, according to the National Agricultural Chemicals Association.

Sales during the year were boosted by a variety of developments, including a series of heavy insect infestations, particularly in the Southeast and Southwest, and a greater use of pesticide chemicals in public health programs throughout the world.

The heaviest insect outbreaks were the Mediterranean fruit fly which threatened the citrus industry in Florida, the spotted alfalfa aphid in the Southwest, and heavier than usual infestations of the boll weevil in the South and the grasshopper in the west.

Markets for pesticides expanded in four different areas during the year: 1) the farm market where more farmers are using pest control chemicals to reduce per unit costs of production; 2) the home garden market — the rapidly increasing number of suburbanites are using these products to grow healthy plants and weed-free lawns; 3) increased use of insecticides in public health programs to wipe out certain diseases through the elimination of disease-carrying insects; 4) increasing use of chemicals to control weeds, brush, insects, and turf diseases along roadsides of the nation's highways.

Safety & Research

Research has been broadened by a number of companies to develop new compounds. An increasing proportion of this research is being devoted to testing the new compounds for residues in or on food, and for toxicity. Company estimates indicate it takes four to five years and

ASHCRAFT-WILKINSON CO.

Fertilizer Materials — *Oil Seed Meals*

Home Office: ATLANTA, GA.
Cable Address
ASHCRAFT

Offices: NORFOLK, VA., CHARLESTON, S. C., TAMPA, FLA.
JACKSON, MISS., COLUMBUS, OHIO, MONTGOMERY, ALA.
DES MOINES, IOWA

Exclusive Distributors: DUVAL SULPHUR & POTASH COMPANY
and ESCAMBIA CHEMICAL CORPORATION

AMMONIATES — FEED STUFFS — SULPHUR — POTASH
INDUSTRIAL AND AGRICULTURAL
CHEMICALS

from $1,200,000 to $1,500,000 to develop a single new pesticide chemical to the marketing stage. Approximately 45 percent of this total goes into making tests to assure the safety of the product. Toxicity tests alone take two to three years, covering the entire life span of test animals.

One result is that pesticide chemicals are among the most thoroughly safety tested materials marketed today. Another result is that fewer new pesticides are likely to be introduced in the future than were during the immediate post-war period. Currently available pesticides, therefore, are likely to have longer market lives.

Research is continuing in fields concerned with chemicals to protect crops in storage and transit. Research also is continuing in the field of systemic pesticides—chemicals which can be applied to plant leaves and are translocated throughout the plant to improve protection against destructive pests.

Grange Approves

The Grange likes the idea advanced by Ike to assign a man full time to promoting and coordinating the Rural Development Program, and the National Grange Master has written True Morse to that effect. Fact is, the Grange was in many ways the original developer of this idea. They do not believe that price supports are of much use to the low-income farmer. Hence their interest and support of the RDP.

Low Costs with FUR-AG®

the sterilized organic conditioner

For years . . . First Choice of Leading Fertilizer Manufacturers

Fur-Ag is an inexpensive organic conditioner that is produced in volume and shipped to you *on schedule* the year around. Fur-Ag reduces bag set, promotes drillability, speeds up curing in the pile and provides bulk. It is sterilized—free from plant diseases, insects, weed seeds—and being dark in color makes a rich-looking piece of goods. Write today for complete information—Bulletin 127.

The Quaker Oats Company
CHEMICALS DEPARTMENT
345 The Merchandise Mart, Chicago 54, Illinois

SOUTHERN STATES PHOSPHATE and FERTILIZER CO.
SAVANNAH, GEORGIA
Manufacturers of SULPHURIC ACID, SUPERPHOSPHATE, COMPLETE FERTILIZERS and ALL TYPES OF BASE GOODS
EXPORT ORDERS SOLICITED

PULVERIZED MASCOT LIMESTONE

REPRESENTATIVE ANALYSIS
Calcium content —$CaCo_3$ value 52.47%
Magnesium content—$CaCo_3$ value 44.23%
Calcium Carbonate —Equivalence 96.70%

MAGNESIUM LIMESTONE
EACH TON OF MASCOT LIMESTONE CONTAINS ABOUT
3.6 Lbs. Zinc
4.8 Lbs. Sulphur
.75 Lbs. Manganese
.05 Lbs. Copper

American Limestone Co.
Box 2389 Knoxville, Tenn.

For Bagging — CHI-ORGANIC — *For Mixing*
(Chicago Activated Sludge)
"THE ALL-ORGANIC PLANT FOOD WITH THE BUILT-IN CONDITIONER"
"Contains more minor elements than any other organic."
CHICAGO FERTILIZER COMPANY
Exclusive Sales Representatives
ALEX. M. McIVER & SON
P. O. Box 155 Charleston, S.C. Tel 3-4828 - 29

CF Staff-Tabulated TONNAGE REPORTS

FERTILIZER TONNAGE REPORT (in equivalent short tons) Compiled by Cooperating State Control Officials and Tabulated by COMMERCIAL FERTILIZER Staff

STATE	November		October		July-Sept. Qtr.		January-June		July-December		YEAR (July-June)	
	1956	1955	1956	1955	1956	1955	1956	1955	1955	1954	1955-56	1954-55
Alabama	.....	37,576[1]	53,799	52,366	73,427	62,490	813,104	846,735	167,372	272,058	1,029,030	1,114,238
Arkansas	.....	5,836[1]	10,719	13,716	33,156	33,567	299,172	270,894	60,299	59,997	359,471	330,781
Georgia	.....	70,201[1]	31,456	35,346	84,808	80,739	993,954	1,047,875	250,968	225,083	1,244,422	1,273,445
Kentucky	.....	8,287[1]	36,595	34,965	38,271	33,388	441,481	431,024	88,119	91,386	529,600	522,410
Louisiana	.....	14,062[1]	25,944	15,019	24,150	22,849	214,343	232,781	59,345	78,067	273,688	310,848
Missouri	.....	30,272[1]	90,574	115,485	177,012	164,002	450,102	414,503	360,210	268,257	804,441	682,690
N. Carolina	.....	35,352[1]	62,001	74,504	67,264	62,174	1,424,267	1,566,158	225,182	264,475	1,649,449	1,830,633
Oklahoma	.....	3,876[1]	20,384	23,619	25,166	40,347	65,854	63,799	69,542	58,405	135,396	122,204
S. Carolina	24,993	26,346	31,701	27,987	43,019	41,355	743,670	796,111	119,947	132,604	863,617	928,715
Tennessee	36,476	40,044	38,202	31,494	58,205	59,120	378,676	355,966	136,925	167,383	515,551	523,349
Texas	44,411	30,227	54,882	58,596	71,436	76,141	377,805	375,176	188,594	212,885	566,399	588,062
California	(reports compiled quarterly)				181,385	173,411	639,377	603,657	361,615	318,270	1,001,554	922,127
Virginia	(reports compiled quarterly)				75,566	71,064	599,111	636,585	162,709	159,085	761,820	795,770
Indiana	(reports compiled semi-annually)						807,918	873,966	242,530	284,994	1,063,049	1,158,960
Iowa	(reports compiled semi-annually)						231,873[1]	.....	.....	.....	.....	.....
N. Hampshire	(reports compiled semi-annually)						13,168[1]	.....	.....	.....	.....	.....
Washington	(reports compiled semi-annually)						103,288	124,186	48,749	58,162	152,037	182,348
TOTAL	105,880	96,617	456,257	482,897	952,866	920,647	8,352,122	8,639,506	2,542,106	2,651,121	10,949,524	11,286,580

.....(not yet reported) * Not compiled [1] Omitted from column total to allow comparison with some period of current year.

MARKETS

ORGANICS: Movement and demand of fertilizer organics continued active up to this writing. Prices are firm and Leather Nitrogenous Tankage continues at previous levels of $3.00 to $4.25 per unit of Ammonia, f.o.b. production points. Some producers are advancing their price 25c per unit of Ammonia effective January 1st.

Activated Sludge prices continue unchanged at $2.95 per unit of Ammonia and 50c per unit of APA, bulk, f.o.b. at a Midwestern production point, with another production in the Southwest priced at $3.00 per unit of Nitrogen and 50c per unit of APA, bulk.

CASTOR POMACE: This market is extremely tight as supplies are almost non-existent. A very limited quantity is periodically produced but is shipped against old commitments. Nominal price is $40.00 per ton f.o.b. New Jersey shipping point in bags.

DRIED BLOOD: The New York market is around $4.25 for sacked unground Blood and the Chicago market around $5.25 to $5.50 f.o.b. Chicago area.

POTASH: No unusual activity is noted in this market with movement beginning to pick up against contract commitments. Prices are firm and unchanged.

GROUND COTTON BUR ASH: Supply and demand are in good balance for this source of Potash which is primarily in the form of Carbonate of Potash. Current analyses are running around 38% to 40% K_2O.

SUPERPHOSPHATE: Demand in the Southeast is beginning to pick up in anticipation of January/forward movement of mixed fertilizers. Prices are steady.

PHOSPHATE ROCK: Prices continue firm with stocks comfortable and movement improving.

SULPHATE OF AMMONIA: Demand is tending to improve for domestic consumption and prices continue steady.

NITRATE OF SODA: No further change in price has been noted and stocks continue to be built for anticipated spring demand. Movement is entirely seasonal.

CALCIUM AMMONIUM NITRATE: Prices continue at $51.25 per ton in bags, f.o.b. usual Atlantic and Gulf ports. Price at one interior production point is $51.00 in bags.

GENERAL: Announcement of increased freight rates effective December 28th stepped up the movement prior to that date of considerable tonnages of raw materials to avoid the freight increase. Most raw materials appear to be in adequate supply for the expected spring needs.

"Step-Flex" Bags Now In Production

Arkell & Smiths have announced that new machinery for manufacturing their stepped-end bag—called the "Step-Flex"—is now in operation at their Wellsburg, W. Va. plant.

This new A & S bag is now offered with either three or four walls at the same price as similar pasted bags. The pressure-glued stepped end at both top and bottom forms a squared-off type construction that facilitates handling, shipping and stacking. Further advantages claimed are less breakage and sifting, and also improved appearance.

Additional plant expansion now underway is expected to bring the annual production of A & S "Step-Flex" bags up to 72,000,000 bags, according to Sheldon Y. Carnes, vice president & general sales manager.

CLASSIFIED ADVERTISING

PLANT SUPERINTENDENT wishes to make a change, 19 years experience in 50 thousand ton capacity plant. Married, 3 children, age 39. Write Box #57, c/o Commercial Fertilizer, 75-3rd St., N.W., Atlanta, Ga., for reference and business resume.

SALESMAN WANTED: To sell high analysis granular complete fertilizers in Mid-South Region. Agricultural background preferred, successful fertilizer sales experience essential. State training, experience, give references. Write Box #51, c/o Commercial Fertilizer, 75 Third St., N.W., Atlanta, Ga.

Technical Sales Representative

Position open for man with good background of practical and technical experience in fertilizer manufacturing or related fields. Job is of a technical nature; not strict sales. Requires college graduate, 35 or under, willing to travel in four Southeastern states. Car and traveling expenses furnished. Salary commensurate with qualifications. Give complete resume of education, experience, and salary desired. Include non-returnable photo. Reply: Director of Personnel, Southern Nitrogen Co., Inc., Box 246, Savannah, Georgia.

WANTED: Used 20 ton hopper trailer unit suitable for transporting phosphate rock and other fertilizer materials. Answer Box #58, c/o Commercial Fertilizer, 75 Third St., N.W., Atlanta, Ga.

FOR SALE: (3) Aluminum Storage Tanks 3000-23,000 gal. Rotary dryers, 3'6" x 25', 4'6" x 32', 4'6" x 40', 104" x 70'. (70) Welded steel storage tanks from 4,300 to 23,000 gal. sizes. Also Mixers, Blenders, Hammer Mills, Pulverizers, Bucket Elevators, Conveyors, etc. Perry Equipment Corporation, 1426 N. 6th St., Philadelphia 22, Pa.

Wiley & Company, Inc.
Analytical and Consulting Chemists
Calvert & Read Streets
BALTIMORE 2, MD.

Cut Production Costs—
Speed up your plant with
ATLANTA UTILITY
FERTILIZER MACHINERY

Fertilizer Mixing Systems	Elevators
Revolving Screens	Fertilizer Shakers
Mixing Plows	Cage Mills
Clod Breakers	Batch Mixers

Write Today for Descriptive Folder
ATLANTA UTILITY WORKS
EAST POINT, GA.

FRED W. KOPITZKE, M. S.
Owner-Director
The Paul Smith Analytical & Consulting Laboratory
ESTABLISHED 1919
FERTILIZER CHEMISTRY
Centrally Located For Fast Service
P. O. Box 576 Indianapolis, Ind. Phone MElrose 6-6161

FOR SALE: Rotary Dryers 5' x 30', 5' x 40', 4'6" x 50', 5' x 67', 6' x 60', 9' x 80'. (1) Pressure Tank 13,000 gal. 220#. Also Mixers, Storage Tanks, Screens, Elevators. Send us your inquiries. Brill Equipment Company, 2402 Third Ave., New York 51, N. Y.

SHUEY & COMPANY, INC.
Specialty: Analysis of Fertilizer Materials and Phosphate Rock. Official Chemists for Florida Hard Rock Phosphate Export Association. Official Weigher and Sampler for the National Cottonseed Products Association at Savannah; also Official Chemist for National Cottonseed Products Association.
115 E. Bay Street, Savannah, Ga.

LAW & COMPANY
Founded 1903
FERTILIZER CHEMISTS
Three Convenient Laboratories
P. O. Box 1558 Atlanta 1, Ga.
P. O. Box 789 Montgomery, Ala.
P. O. Box 629 Wilmington, N. C.

Serving the
FERTILIZER INDUSTRY
Fertilizer Equipment Sales Corp.
Designers — Engineers — Manufacturers of Fertilizer Machinery

Sales and engineering office:	Manufacturing plant:
P. O. Box 1968	P. O. Box 67
130 Krog St., N. E.	1641 Poland St.
Atlanta, Ga.	New Orleans, La.
Phone JAckson 3-6615	Phone Bywater 8373

Lancaster, Allwine & Rommel
Registered Patent Attorneys
Suite 482
815—15th STREET, N. W.
Washington 5, D.C.

Patent Practice before U. S. Patent Office. Validity and Infringement Investigations and Opinions.

Booklet and form "Evidence of Conception" forwarded upon request.

LEAD LINED EQUIPMENT

or

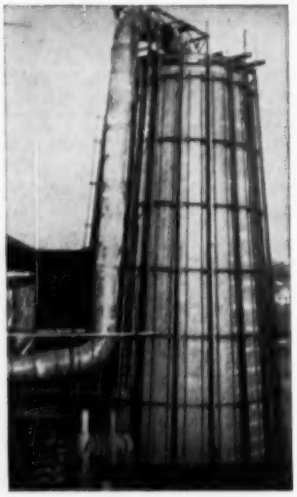
Construction

of

Complete

Acid

Plants



Southern Lead Burning Co.

ATLANTA 2, Ga.

P. O. Box 4627 Tel. WAlnut 2576

Specialists in

Magnesia for Agriculture

EMJEO (80/82% Magnesium Sulphate)
Calcined Brucite (fertilizer grade) 65% MgO

POTNIT

95% Nitrate of Potash) for Special Mixtures and Soluble Fertilizers
Other Fertilizer Materials

BERKSHIRE

ISCO

Insecticides—

Fungicides

Mercury Compounds
for Agricultural Use

Dithiocarbamates

Ferric—Zinc

EXPORT - IMPORT

BERKSHIRE CHEMICALS, INC.

GRAYBAR BUILDING
420 LEXINGTON AVENUE • NEW YORK 17
LExington 2-5959 • "BERKSKEM" New York
55 New Montgomery St. • San Francisco 5, Cal.
Philadelphia • Boston • Cleveland • Chicago

INDEX TO ADVERTISERS

Allied Chemical & Dye Corp.,
Nitrogen Div. ..... Front Cover, 19, 20, 21, 22
American Agricultural Chemical Company, The .....
American Limestone Co. 67
American Potash & Chemical Corporation .....
Arkell and Smiths 14
Armour Fertilizer Works 58
Ashcraft-Wilkinson Co. 33, 35, 53, 66
Atlanta Utility Works 69
B. I. F. Industries, Omega Machine Company .....

Bagpak Division, International Paper Co. .....
Bemis Bro. Bag Co. 12
Berkshire Chemicals, Inc. 70
Blaw-Knox Company, Blaw-Knox Equipment Division .....
Blue Valley Equip. Mfg. & Engr. Co. .....
Bradley & Baker 31, 35, 38
Burlap Council of Indian Jute Mills Assn. .....

Chase Bag Company .....
Chemical Construction Corporation .....
Chemical Plants Division—Blaw-Knox Company .....
Chicago Fertilizer Company 67
Cole Manufacturing Co., R. D. 65
Commercial Solvents Corporation 28, 29

Davidson-Kennedy Co. .....
Davison Chemical Co. Div. W. R. Grace & Co. 9
Dow Chemical Company, The .....
du Pont De Nemours & Co. (Inc.), E. I. 49
Duval Sulphur and Potash Co. 53

Emulsol Chemical Corp. .....
Escambia Chemical Corp. 33
Evans Metal Company .....

Fertilizer Equipment Sales Corporation 69
Fulton Bag & Cotton Mills .....

General American Transportation Corporation .....
Grace Chemical Company Div. W. R. Grace & Co. .....
Grand River Chemical Div. Deere & Co. .....

Hough Company, The Frank G. 16, 17

International Minerals & Chemical & Corporation
Phosphate Chemicals Division 6, 7
Phosphate Minerals Division .....
Potash Division .....
International Paper Company .....

Kent Bag Company, Inc., Percy 10
Kopitzke, Fred W. 69
Koppers Company, Inc. (Tar Products Div.
Kraft Bag Corporation ..... Inside Front Cover

Lancaster Allwine & Rommel 69
Law & Company 69
Link-Belt Company .....
Longhorn Construction Co. 65
Lummus Company The 44

Marietta Concrete Corporation The 62
McDermott Bros., Co. .....
McIver & Son Alex. M. 65, 67
Mississippi River Chemical Co. 35
Moores Lime Co., The 58
Monsanto Chemical Co. 57

National Lime and Stone Co., The 65
National Potash Company 45
Nitroform Agricultural Chemicals, Inc. 8
Nitrogen Division (Allied Chemical & Dye
Corp.) ..... Front Cover, 19, 20, 21, 22

Omega Machine Company, B. I. F. Industries .....

Phelps Dodge Refining Corporation .....
Phillips Chemical Company .....
Potash Company of America ..... Inside Back Cover

Quaker Oats Company, The (Chemicals Dept.) 67

Raymond Bag Corporation .....
Refined Products Corporation 24
Renneburg & Sons Co., Edw. .....

Sackett and Sons Co., The A. J. 36, 37
St. Regis Paper Company, Multiwall Bag Division .....
Shuey & Co., Inc. 69
Simplicity Engineering Company 54
Sinclair Chemicals, Inc. 15
Smith-Rowland Company 3
Sohio Chemical Company .....
Southern Lead Burning Co. 70
Southern States Phosphate and Fertilizer Co. 67
Southwest Potash Corp. 18
Spencer Chemical Company .....
Stedman Foundry & Machine Company, Inc. 60
Stephens-Adamson Manufacturing Company .....
Lewis J. Stone Co. .....
Sturtevant Mill Company .....

Tennessee Corporation 31
Texas Company, The, Petrochemical Sales Division 11
Texas Gulf Sulphur Co. .....
Tull Metal & Supply Co., Inc., J. M. 60

Union Bag-Camp Paper Corporation 23
Union Special Machine Co. ..... Back Cover
U. S. Industrial Chemicals Co., Chemical Div. 13
U. S. Phosphoric Products Division, Tennessee Corp. 31
United States Potash Company,
Div. United States Borax & Chemical Corp. 41

Weatherly Company, The D. M. 4
Wiley & Company, Inc. 69
Willingham-Little Stone Company 61
Woodward & Dickerson, Inc. .....

To all our friends, Happy New Year!

May your hearths burn bright and your
loads be light.

Your cup brimful with cheer.

And may all go right, without
drought or blight

Throughout the coming year.

P.C.A.
SALT of the EARTH
RED MURIATE

POTASH COMPANY OF AMERICA
CARLSBAD, NEW MEXICO.

General Sales Office . . . 1625 Eye Street, N.W., Washington, D.C.
Midwestern Sales Office . . . First National Bank Bldg., Peoria, Ill.
Southern Sales Office . . . Candler Building, Atlanta, Ga.

HEAVY DUTY BAG CLOSING

UNION SPECIAL builds sewing heads and auxiliary equipment for closing all types and sizes of filled bags. These sewing heads set the standard the world over for speed, economy, and dependability — wherever the product is bagged. They stand up longer in all kinds of service and under the most severe working conditions. They are capable of high production day-in and day-out. For detailed information, ask for a copy of Bulletin No. 200. See our nearest representative or write today.

— calls for

Union Special® equipment!

Union Special MACHINE COMPANY
412 North Franklin St.
Chicago 10, Ill.

● SEND FOR BULLETIN No. 200

STYLE 20500 B

This heavy duty unit is designed for closing 100 lb. textile or multiwall paper bags at rates up to 3,840 bags per 8 hr. day. Gear driven horizontal and inclined conveyor. Counterbalanced sewing head easily adjustable for height of bag. Sewing speed synchronized with conveyor speed. Choice of controls.